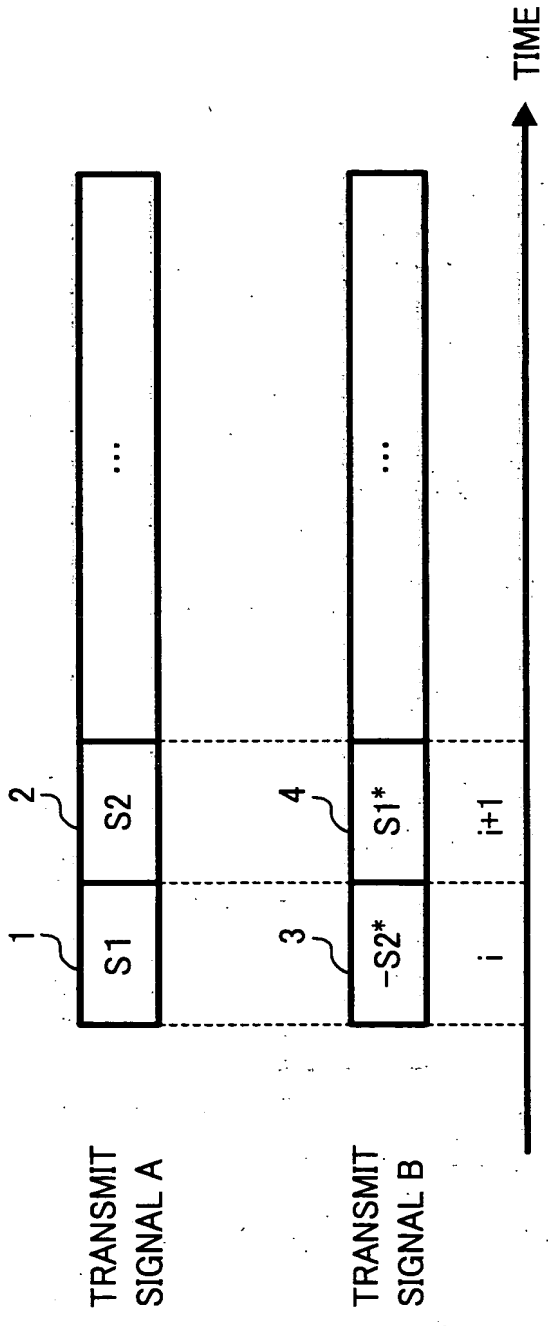


FIG.1A

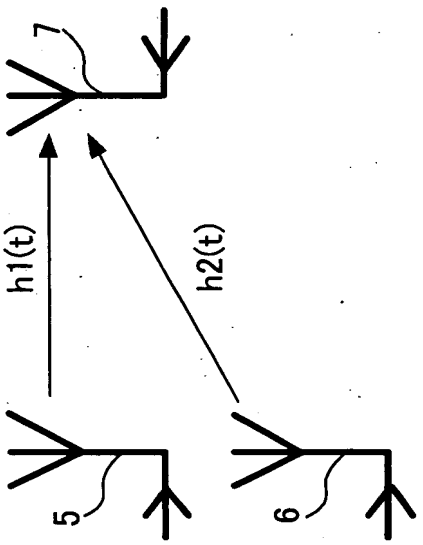


FIG.1B

(PRIOR ART)

FIG.2A

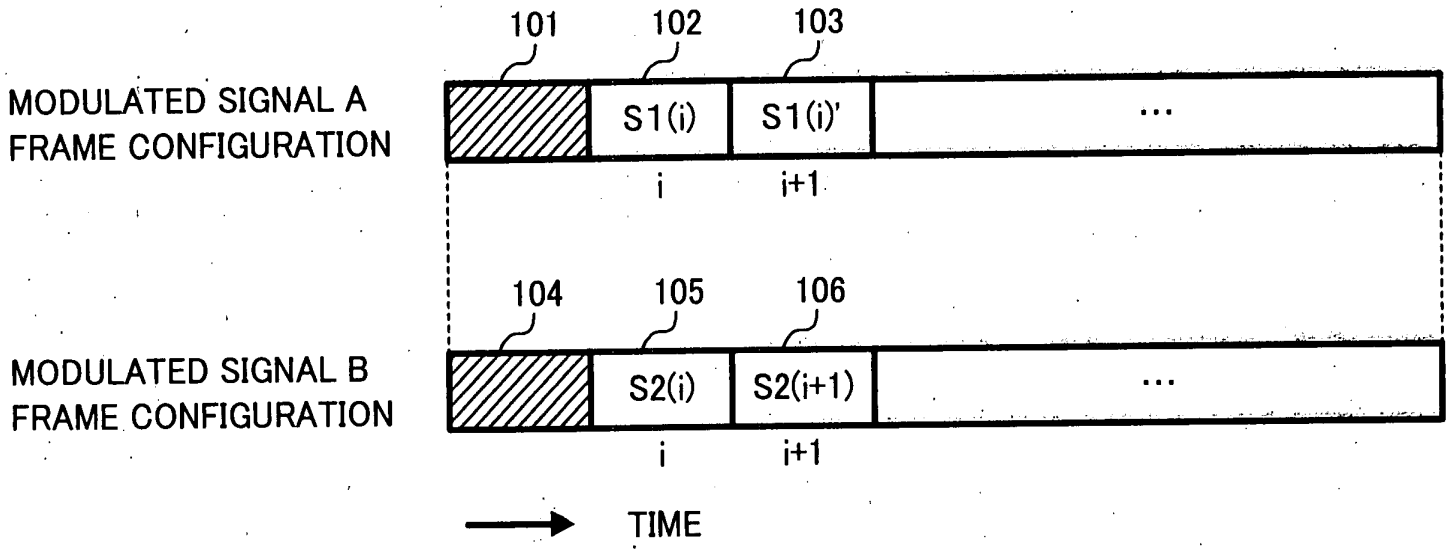
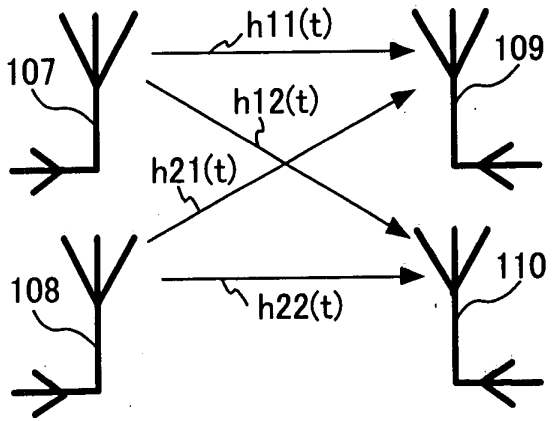


FIG.2B



(PRIOR ART)

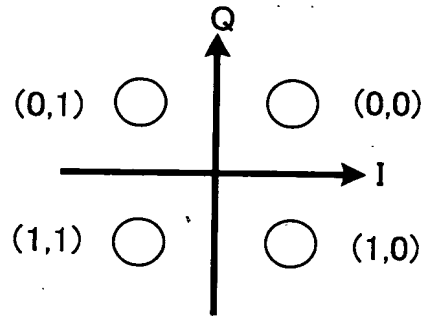


FIG.3A S1(i) SIGNAL POINT ARRANGEMENT

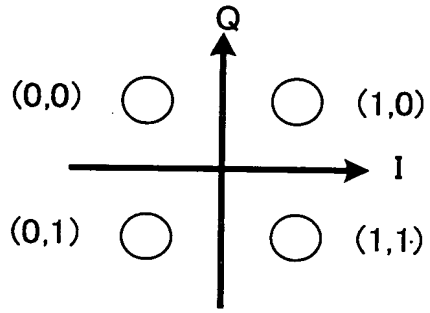


FIG.3B S1(i)' SIGNAL POINT ARRANGEMENT

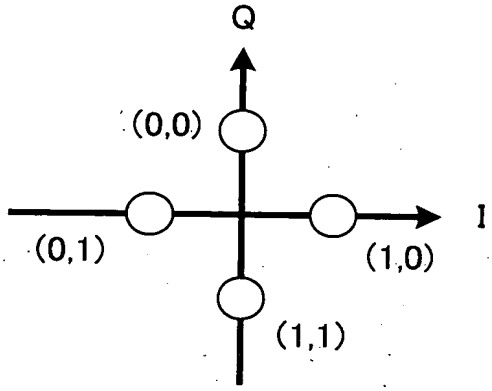


FIG.3C S1(i)' SIGNAL POINT ARRANGEMENT

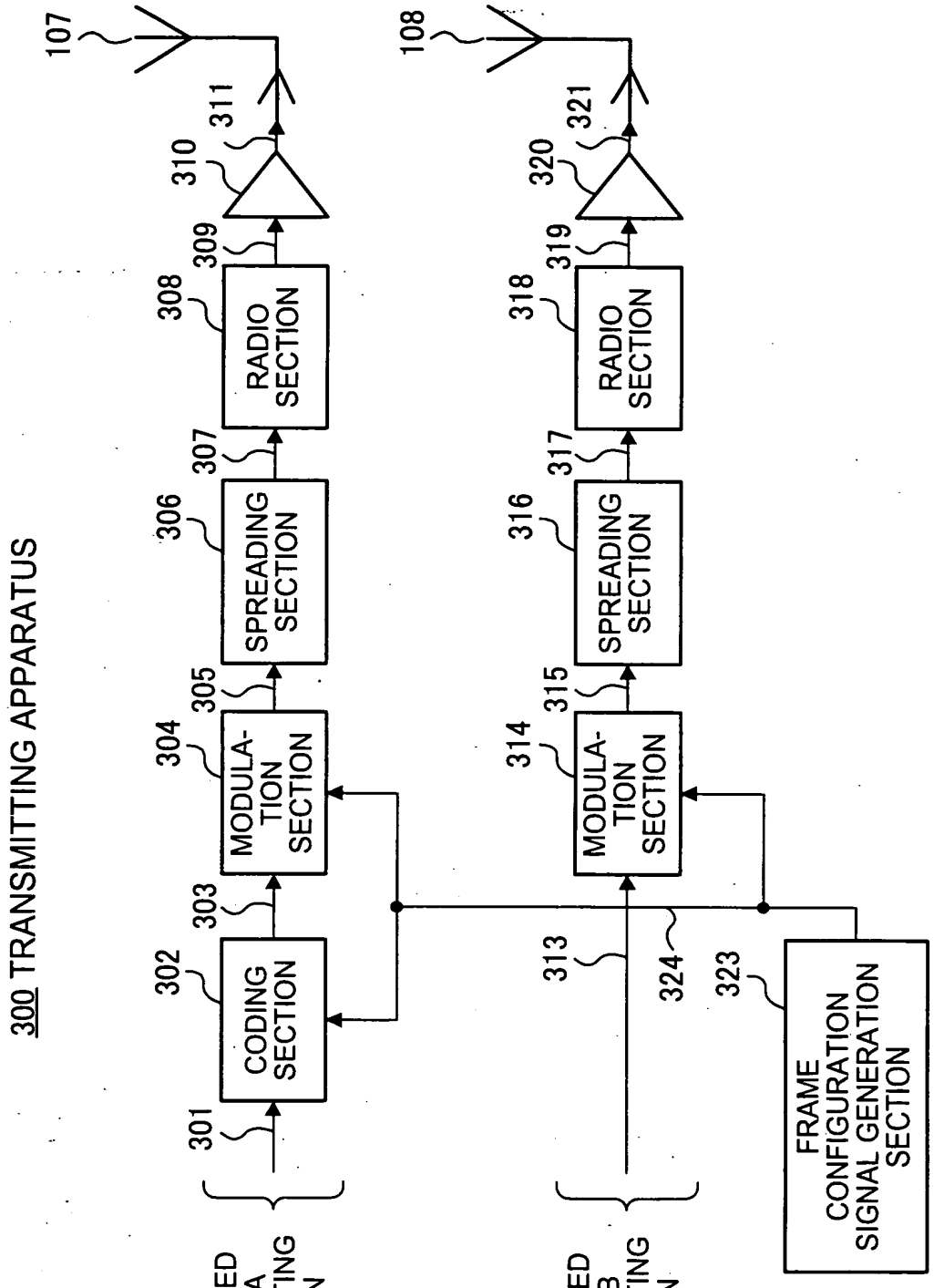

300 TRANSMITTING APPARATUS
107
108
311
321
310
320
309
319
308
318
RADIO SECTION
RADIO SECTION
307
317
306
316
SPREADING SECTION
SPREADING SECTION
305
315
304
314
MODULA-TION SECTION
MODULA-TION SECTION
303
313
324
302
323
CODING SECTION
FRAME CONFIGURATION SIGNAL GENERATION SECTION
301
MODULATED SIGNAL A TRANSMITTING SECTION
MODULATED SIGNAL B TRANSMITTING SECTION

FIG.4

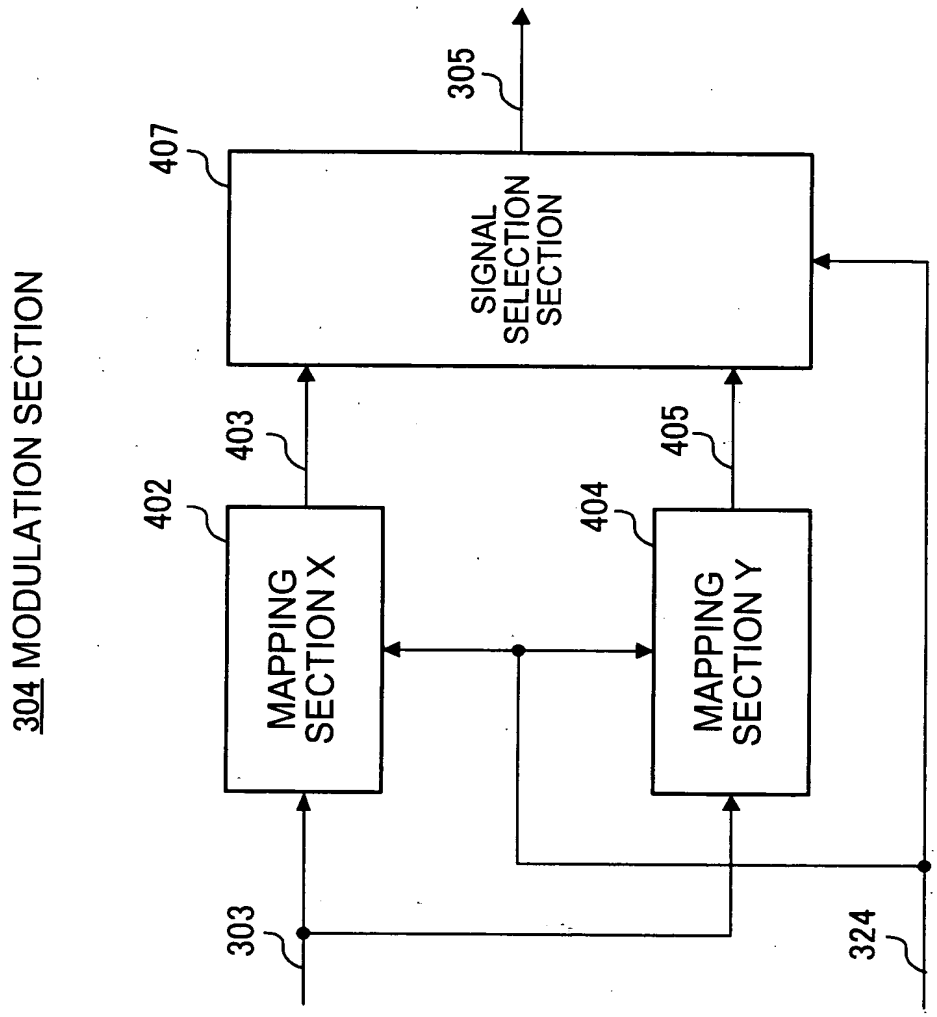

304 MODULATION SECTION
305
407
SIGNAL SELECTION SECTION
403
405
402
404
MAPPING SECTION X
MAPPING SECTION Y
303
324

FIG.5

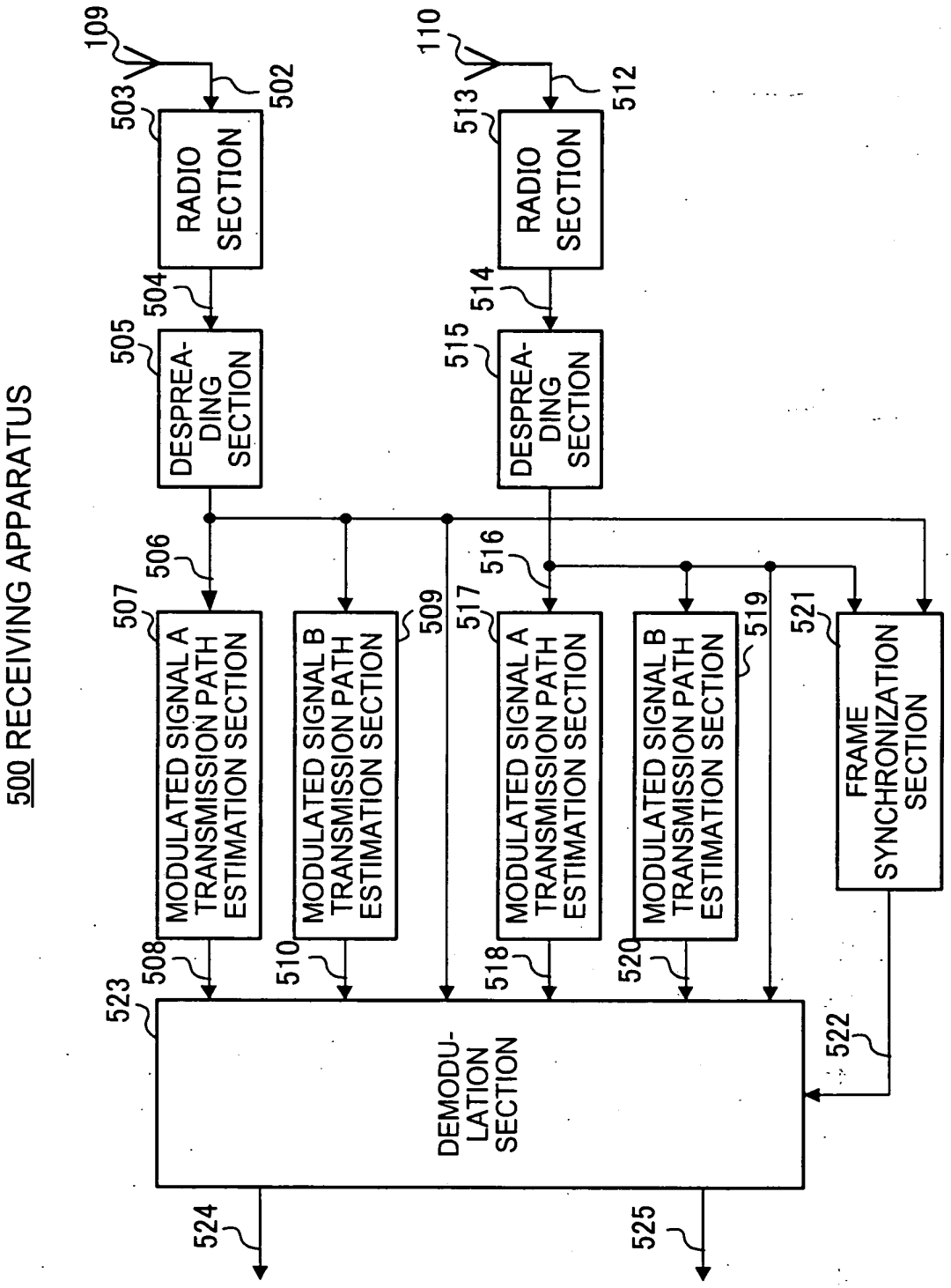

500 RECEIVING APPARATUS
109
110
503
513
502
512
RADIO SECTION
RADIO SECTION
504
514
505
515
DESPREA-DING SECTION
DESPREA-DING SECTION
506
516
507
517
509
519
521
MODULATED SIGNAL A TRANSMISSION PATH ESTIMATION SECTION
MODULATED SIGNAL B TRANSMISSION PATH ESTIMATION SECTION
MODULATED SIGNAL A TRANSMISSION PATH ESTIMATION SECTION
MODULATED SIGNAL B TRANSMISSION PATH ESTIMATION SECTION
FRAME SYNCHRONIZATION SECTION
508
510
518
520
523
522
DEMODU-LATION SECTION
524
525

FIG.6

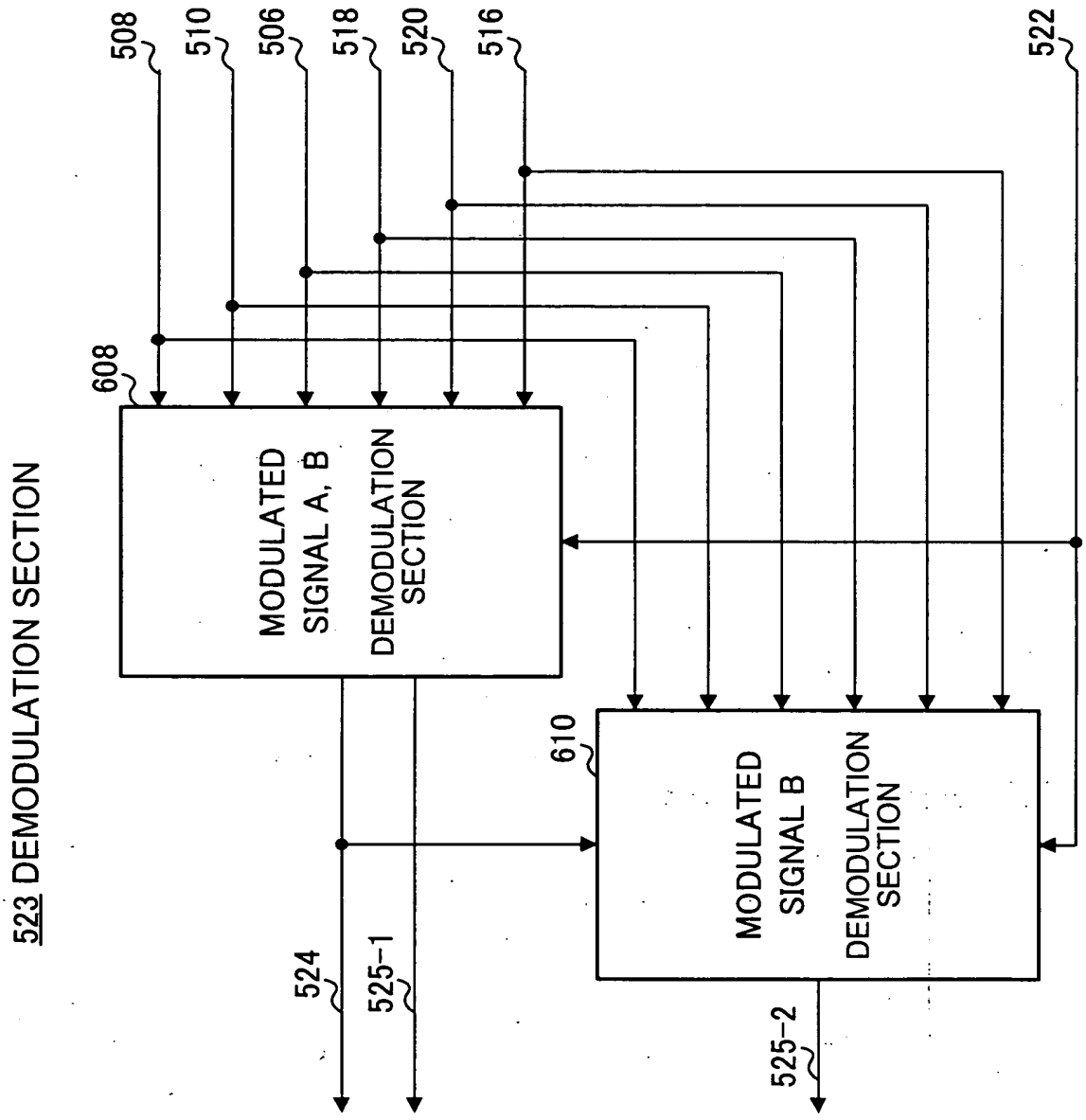

523 DEMODULATION SECTION
508
510
506
518
520
516
522
608
MODULATED SIGNAL A, B DEMODULATION SECTION
610
MODULATED SIGNAL B DEMODULATION SECTION
524
525-1
525-2

FIG.7

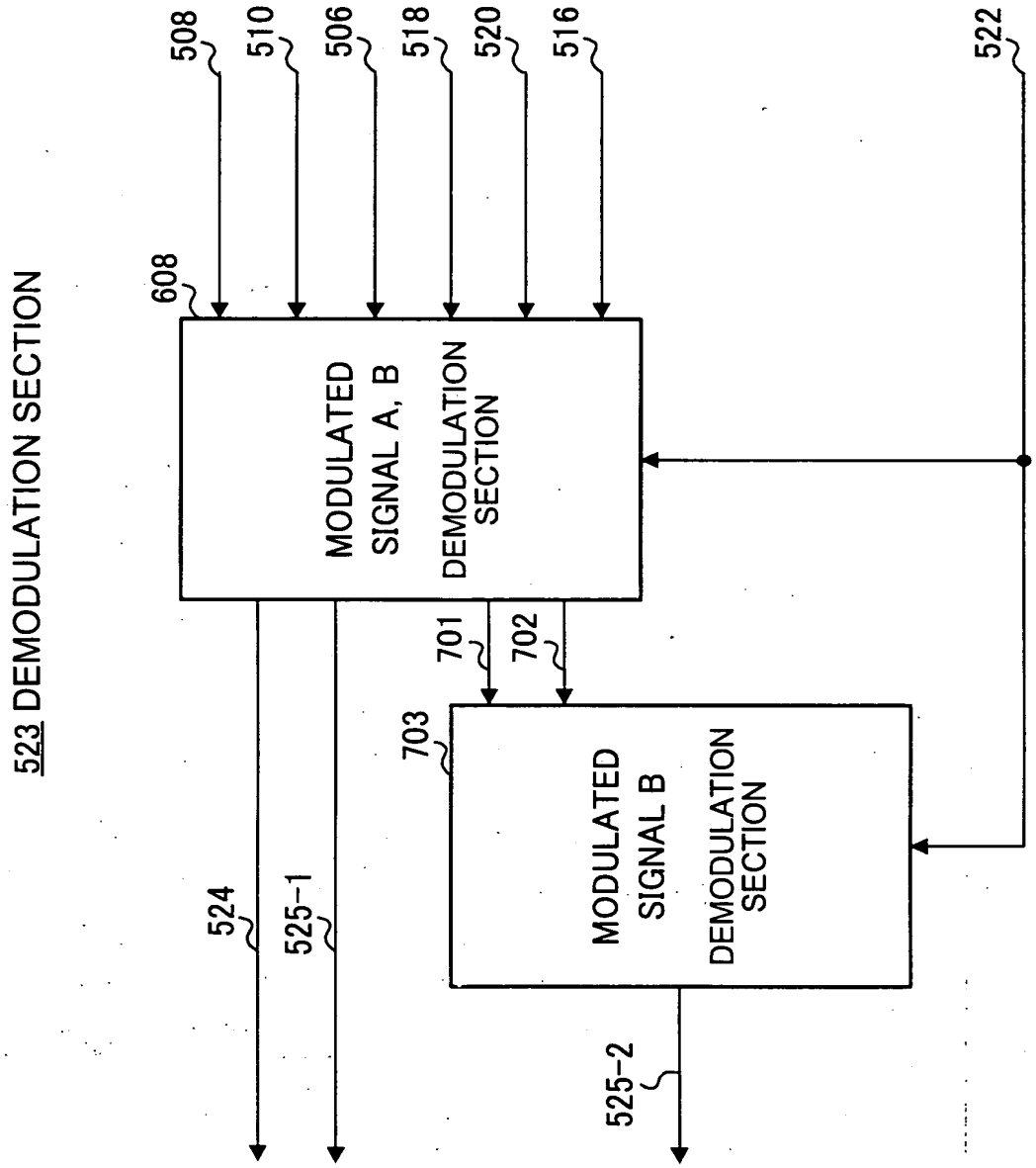

523 DEMODULATION SECTION
508
510
506
518
520
516
522
608
MODULATED SIGNAL A, B DEMODULATION SECTION
701
702
703
MODULATED SIGNAL B DEMODULATION SECTION
524
525-1
525-2

FIG.8

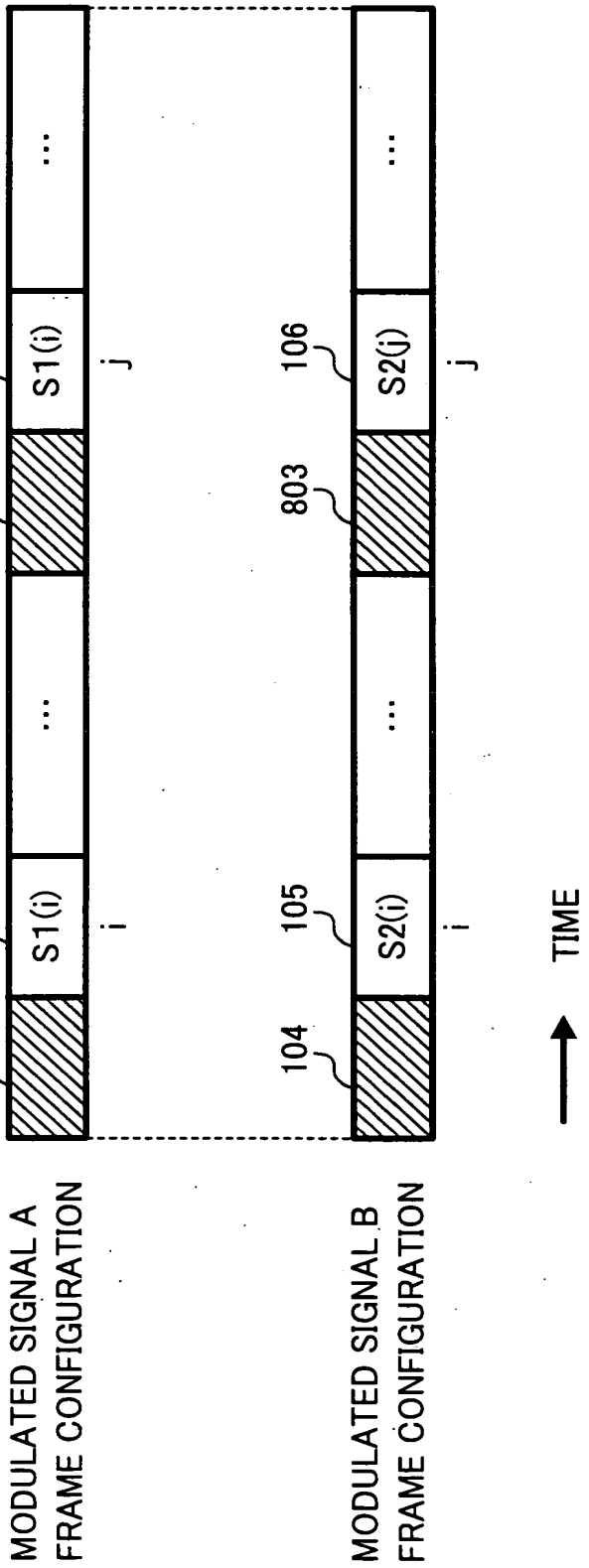

MODULATED SIGNAL A
FRAME CONFIGURATION
MODULATED SIGNAL B
FRAME CONFIGURATION
101
102
104
105
106
801
802
803
S1(i)
S2(i)
i
j
TIME

FIG.9

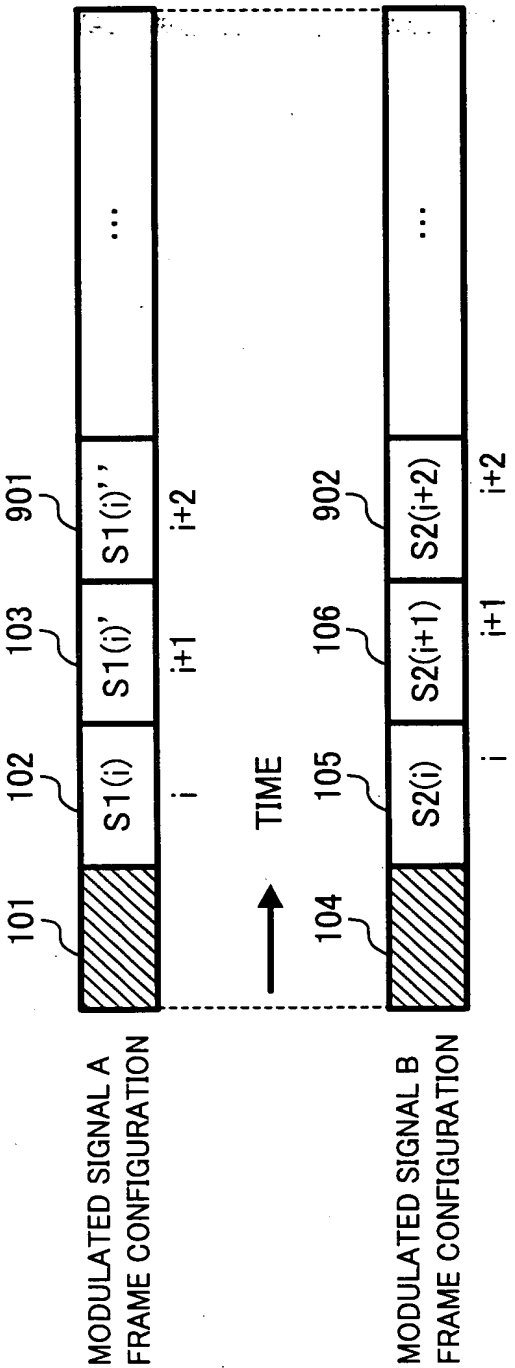


FIG.10A

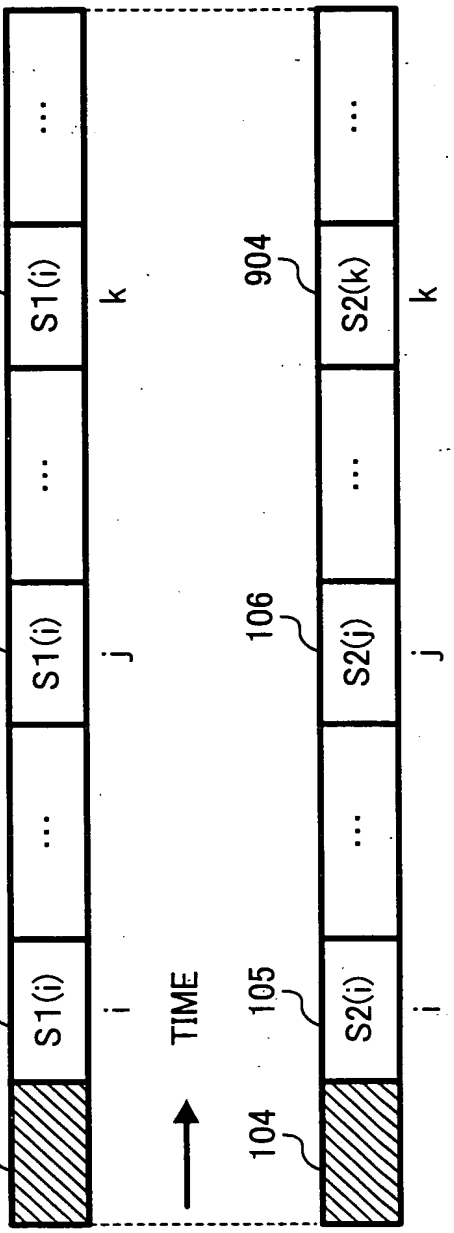


FIG.10B

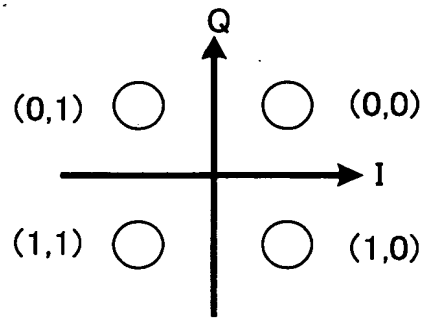


FIG.11A S1(i) SIGNAL POINT ARRANGEMENT

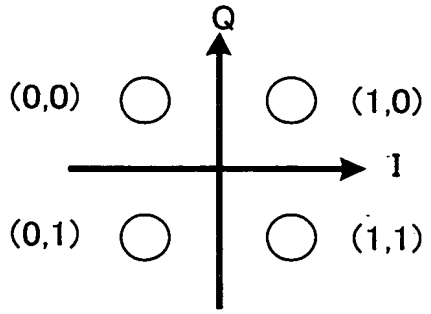


FIG.11B S1(i)' SIGNAL POINT ARRANGEMENT

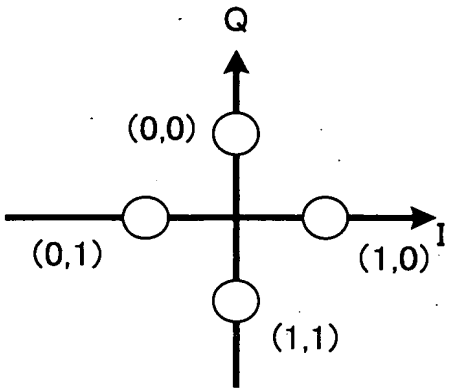


FIG.11C S1(i)" SIGNAL POINT ARRANGEMENT

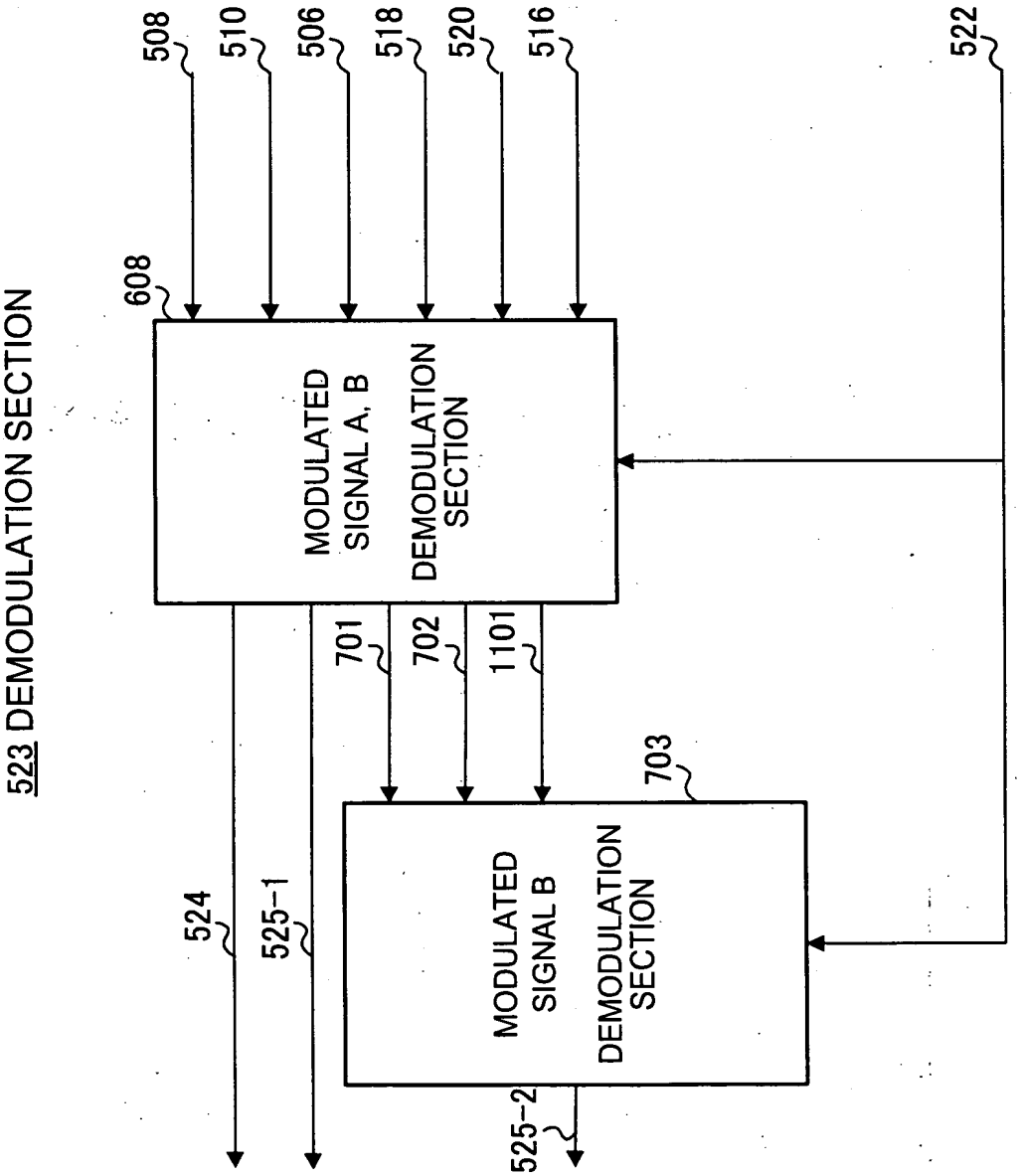

523 DEMODULATION SECTION
508
510
506
518
520
516
522
608
MODULATED SIGNAL A, B DEMODULATION SECTION
701
702
1101
703
524
525-1
MODULATED SIGNAL B DEMODULATION SECTION
525-2

FIG.12

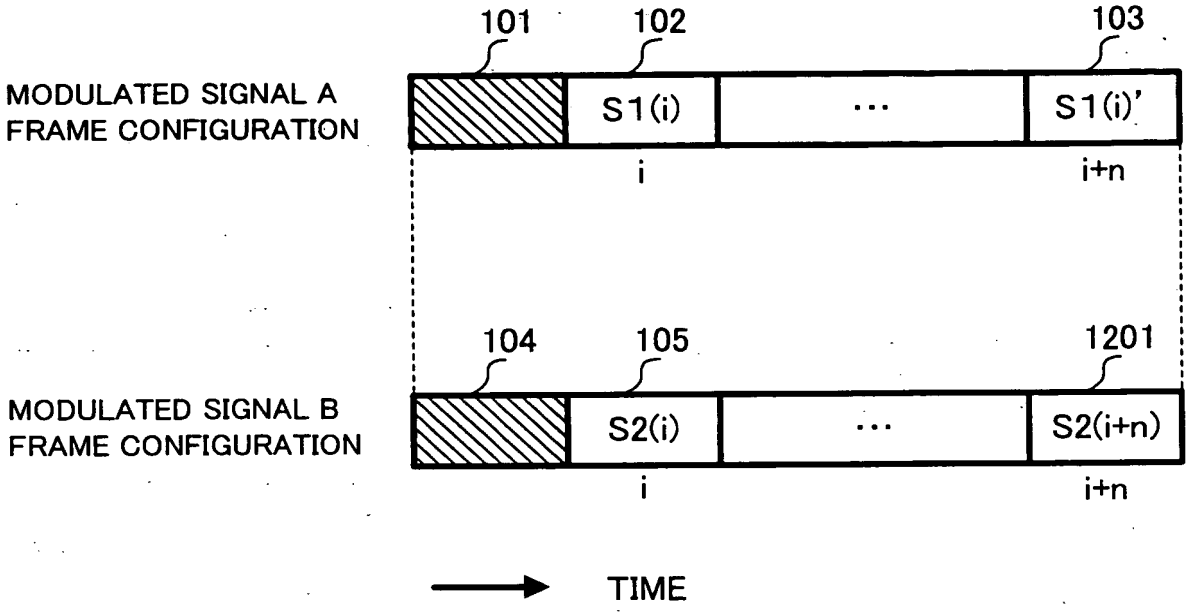

101
102
103
MODULATED SIGNAL A
FRAME CONFIGURATION
S1(i)
...
S1(i)'
i
i+n
104
105
1201
MODULATED SIGNAL B
FRAME CONFIGURATION
S2(i)
...
S2(i+n)
i
i+n
TIME

FIG.13

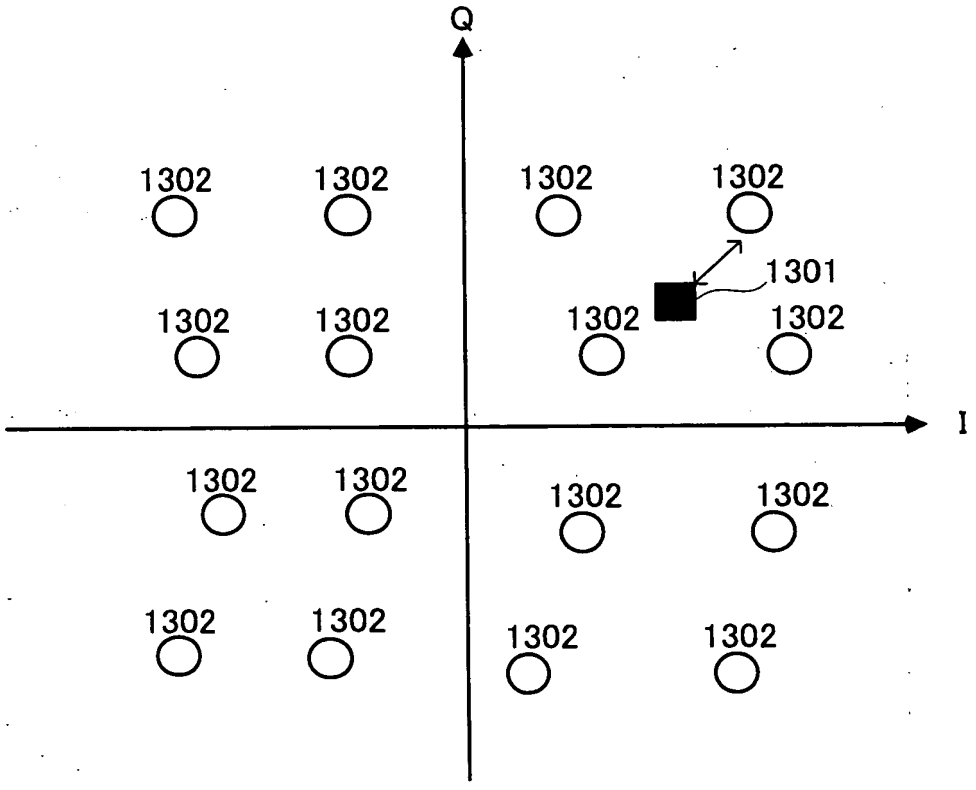

Q
I
1301
1302

FIG.14

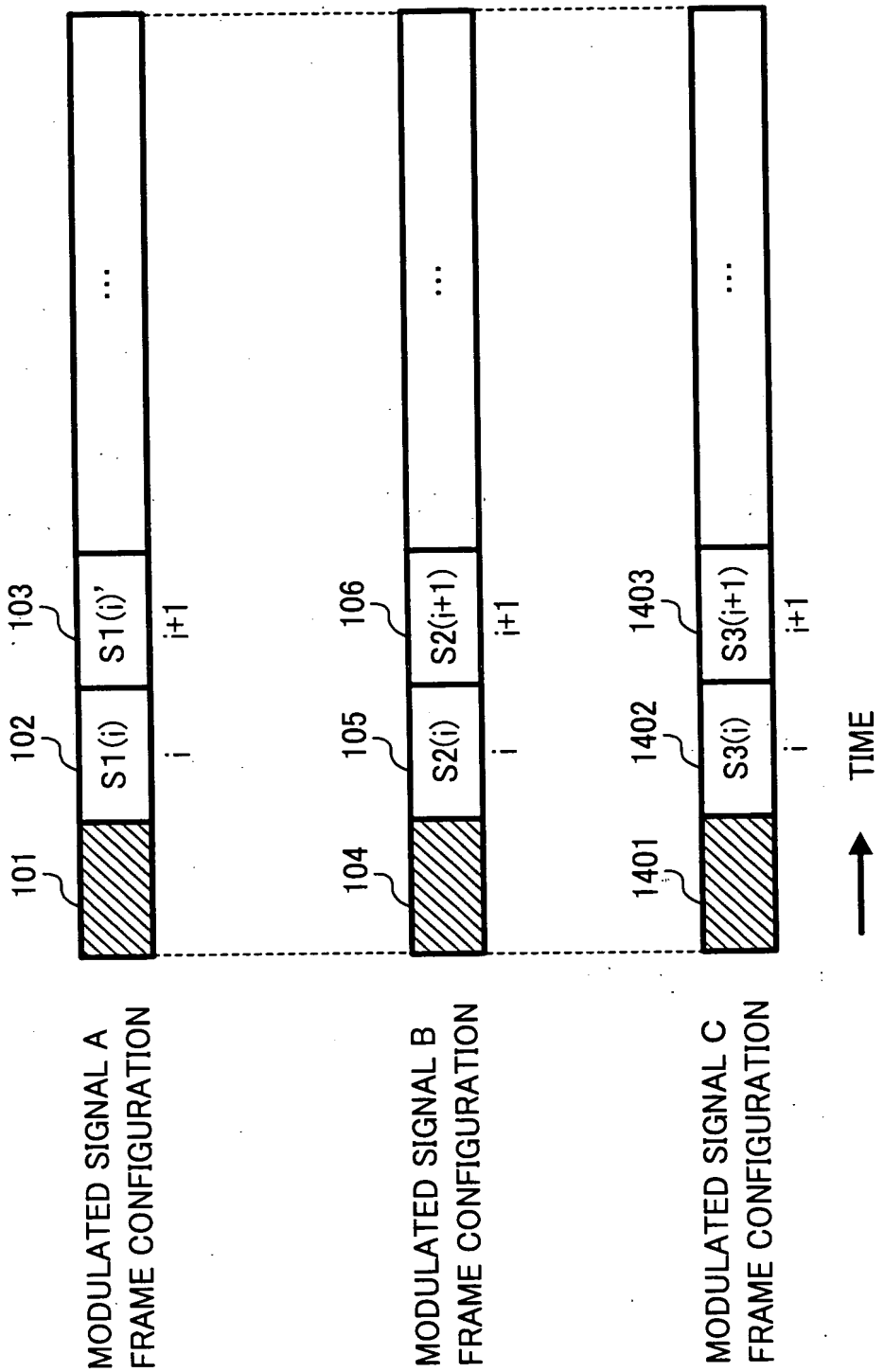

MODULATED SIGNAL A
FRAME CONFIGURATION
MODULATED SIGNAL B
FRAME CONFIGURATION
MODULATED SIGNAL C
FRAME CONFIGURATION
101
102
103
104
105
106
1401
1402
1403
S1(i)
S1(i)'
S2(i)
S2(i+1)
S3(i)
S3(i+1)
i
i+1
TIME

FIG.15

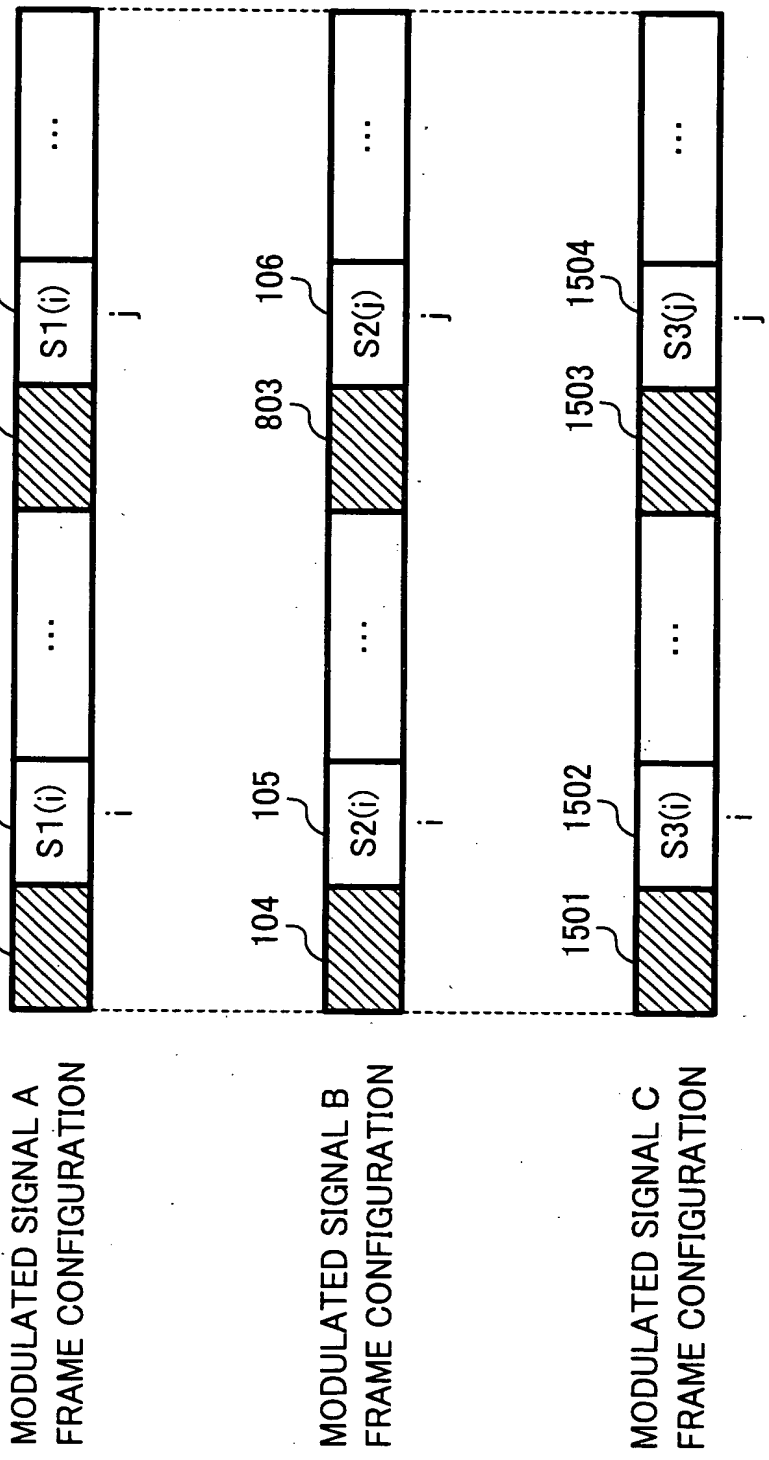

MODULATED SIGNAL A
FRAME CONFIGURATION
MODULATED SIGNAL B
FRAME CONFIGURATION
MODULATED SIGNAL C
FRAME CONFIGURATION
TIME
101
102
104
105
801
802
803
106
1501
1502
1503
1504
S1(i)
S2(i)
S3(i)
S1(j)
S2(j)
S3(j)
i
j

FIG.16

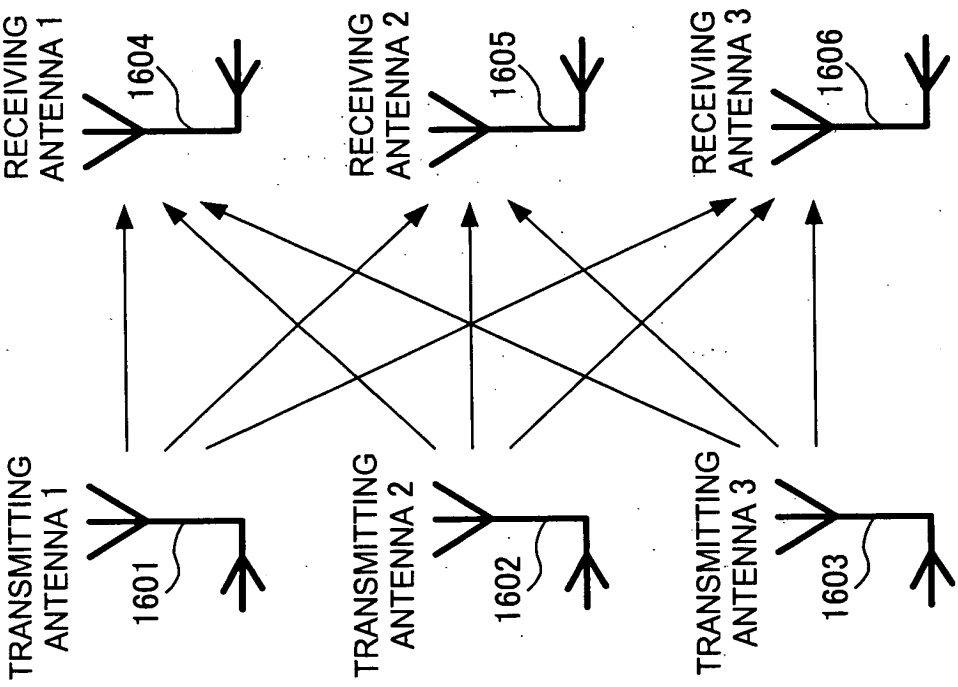

RECEIVING ANTENNA 1
1604
RECEIVING ANTENNA 2
1605
RECEIVING ANTENNA 3
1606
TRANSMITTING ANTENNA 1
1601
TRANSMITTING ANTENNA 2
1602
TRANSMITTING ANTENNA 3
1603

FIG.17

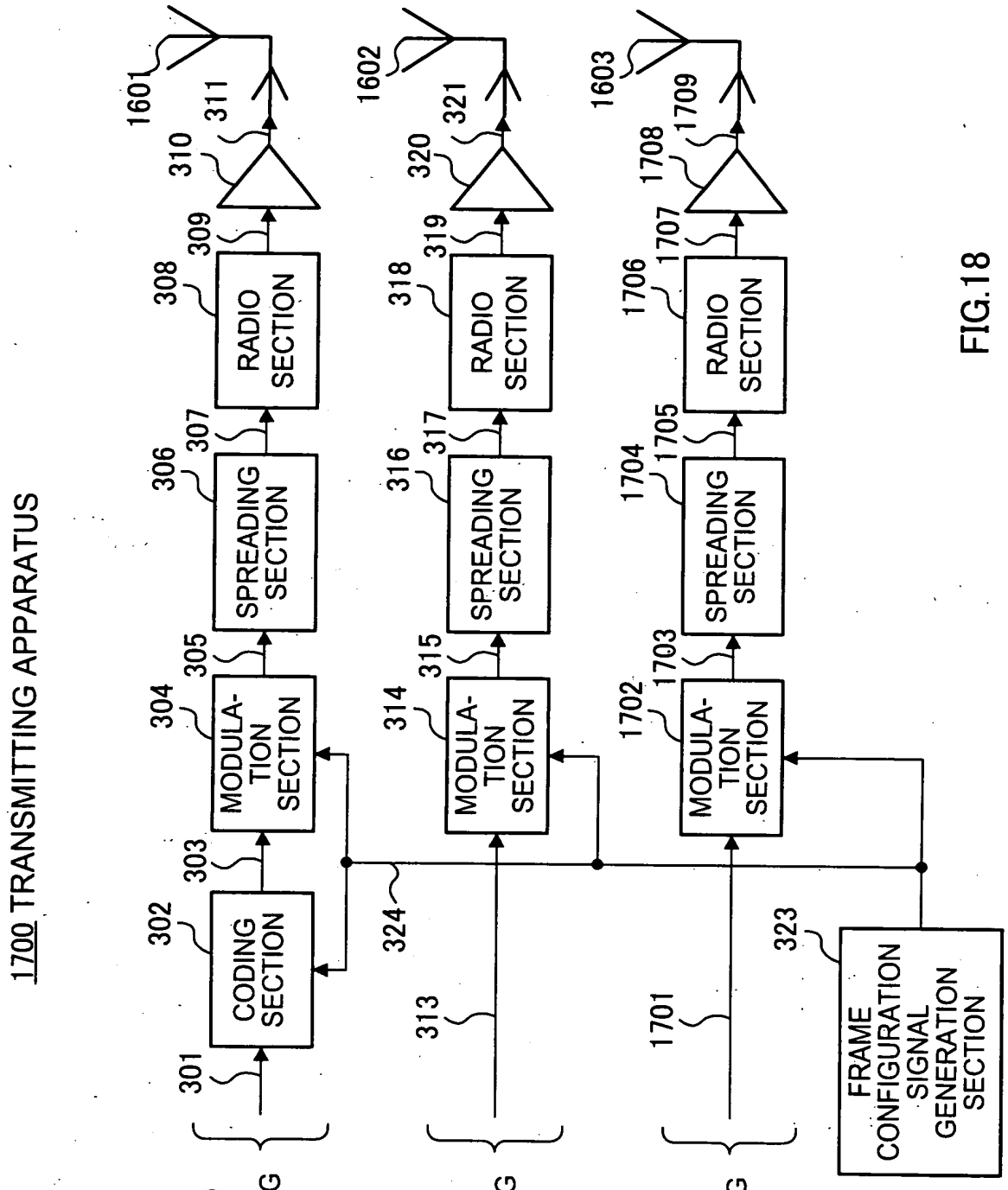

1700 TRANSMITTING APPARATUS
MODULATED SIGNAL A TRANSMITTING SECTION
MODULATED SIGNAL B TRANSMITTING SECTION
MODULATED SIGNAL C TRANSMITTING SECTION
CODING SECTION
MODULATION SECTION
SPREADING SECTION
RADIO SECTION
FRAME CONFIGURATION SIGNAL GENERATION SECTION
301
302
303
304
305
306
307
308
309
310
311
313
314
315
316
317
318
319
320
321
323
324
1601
1602
1603
1701
1702
1703
1704
1705
1706
1707
1708
1709

FIG.18

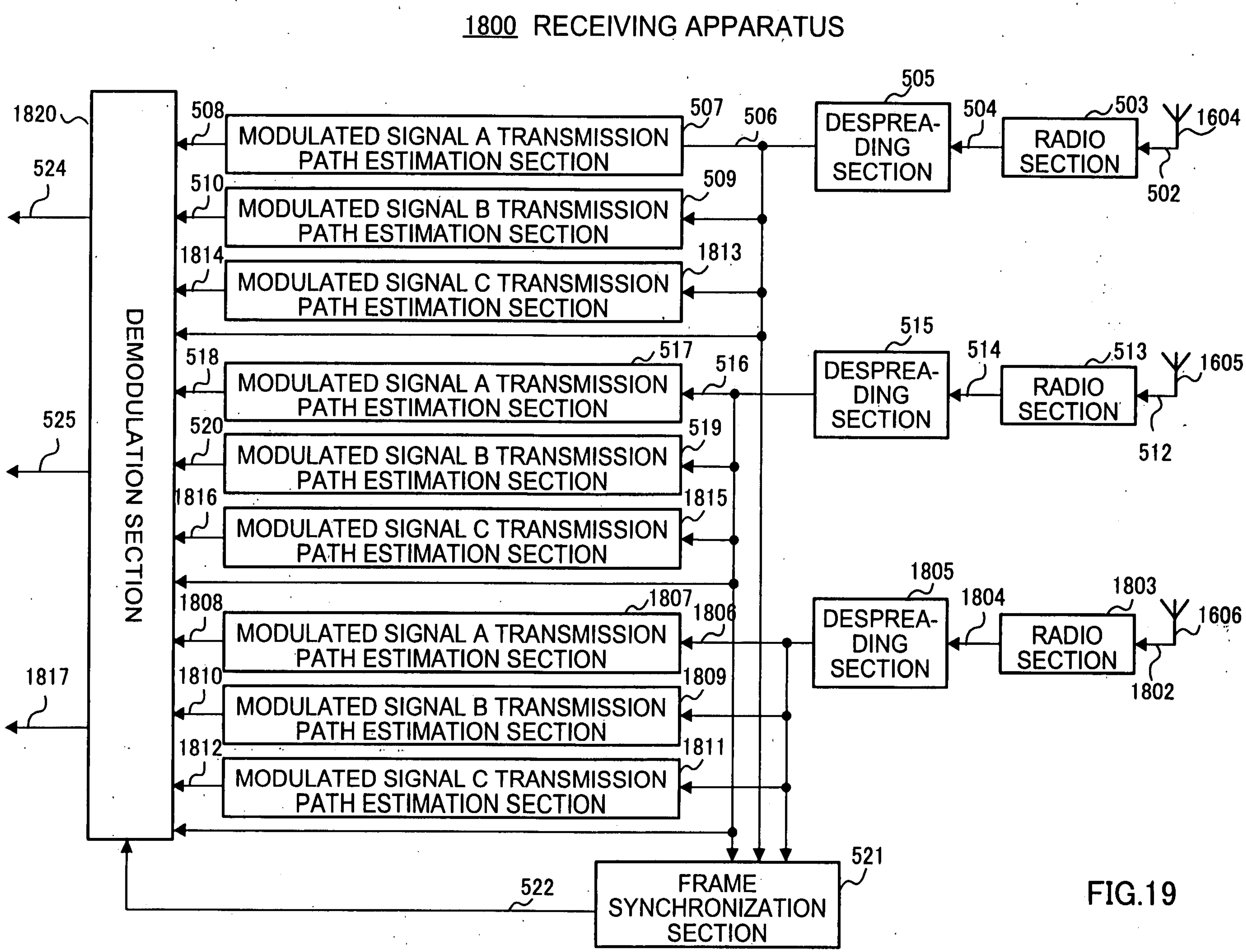

1800 RECEIVING APPARATUS
1604
502
RADIO SECTION
503
504
DESPREADING SECTION
505
506
1605
512
RADIO SECTION
513
514
DESPREADING SECTION
515
516
1606
1802
RADIO SECTION
1803
1804
DESPREADING SECTION
1805
1806
MODULATED SIGNAL A TRANSMISSION PATH ESTIMATION SECTION
507
508
MODULATED SIGNAL B TRANSMISSION PATH ESTIMATION SECTION
509
510
MODULATED SIGNAL C TRANSMISSION PATH ESTIMATION SECTION
1813
1814
MODULATED SIGNAL A TRANSMISSION PATH ESTIMATION SECTION
517
518
MODULATED SIGNAL B TRANSMISSION PATH ESTIMATION SECTION
519
520
MODULATED SIGNAL C TRANSMISSION PATH ESTIMATION SECTION
1815
1816
MODULATED SIGNAL A TRANSMISSION PATH ESTIMATION SECTION
1807
1808
MODULATED SIGNAL B TRANSMISSION PATH ESTIMATION SECTION
1809
1810
MODULATED SIGNAL C TRANSMISSION PATH ESTIMATION SECTION
1811
1812
FRAME SYNCHRONIZATION SECTION
521
522
DEMODULATION SECTION
1820
524
525
1817

FIG.19

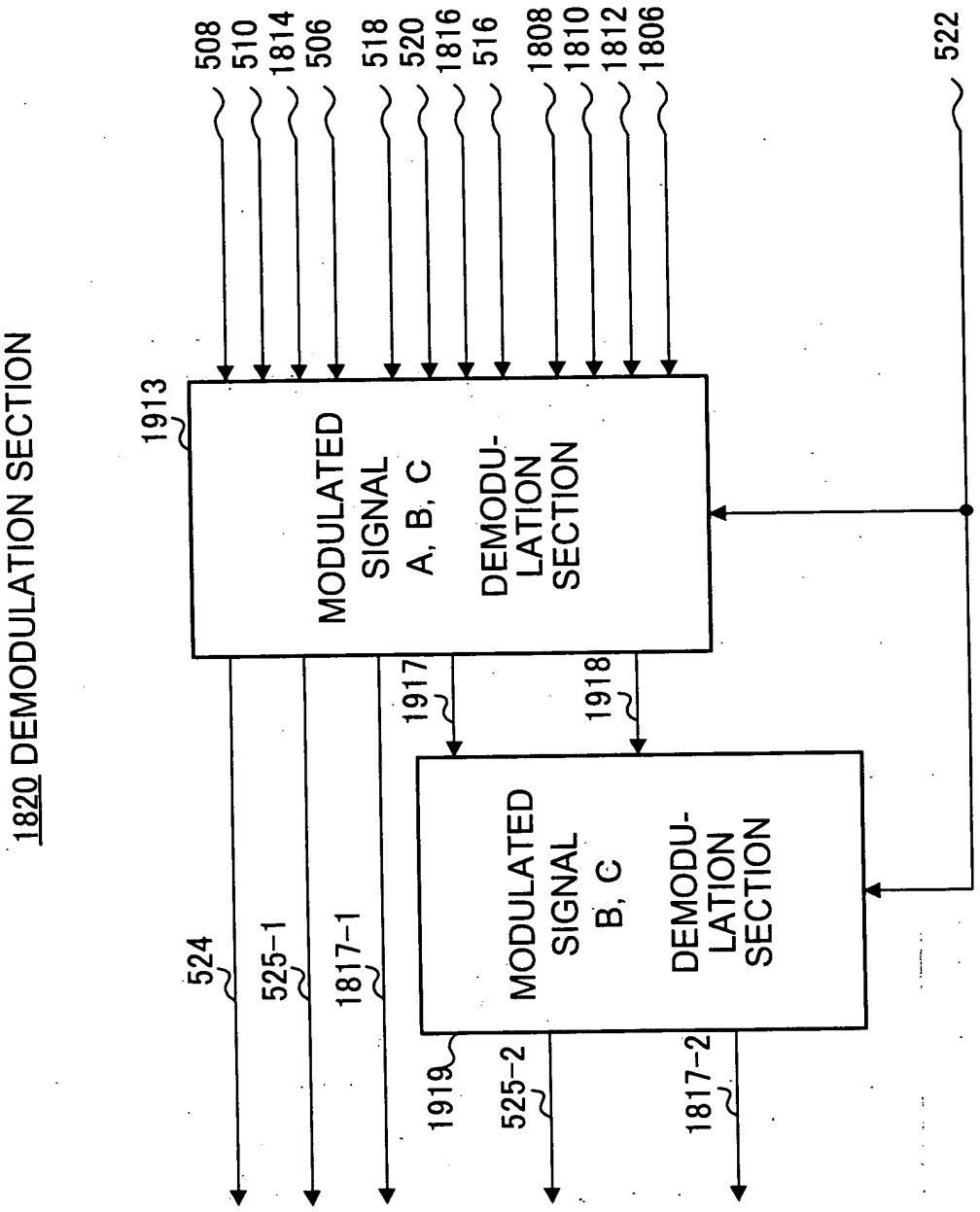

1820 DEMODULATION SECTION
508
510
1814
506
518
520
1816
516
1808
1810
1812
1806
522
1913
MODULATED SIGNAL A, B, C
DEMODU-LATION SECTION
1917
1918
524
525-1
1817-1
MODULATED SIGNAL B, C
DEMODU-LATION SECTION
1919
525-2
1817-2

FIG.20

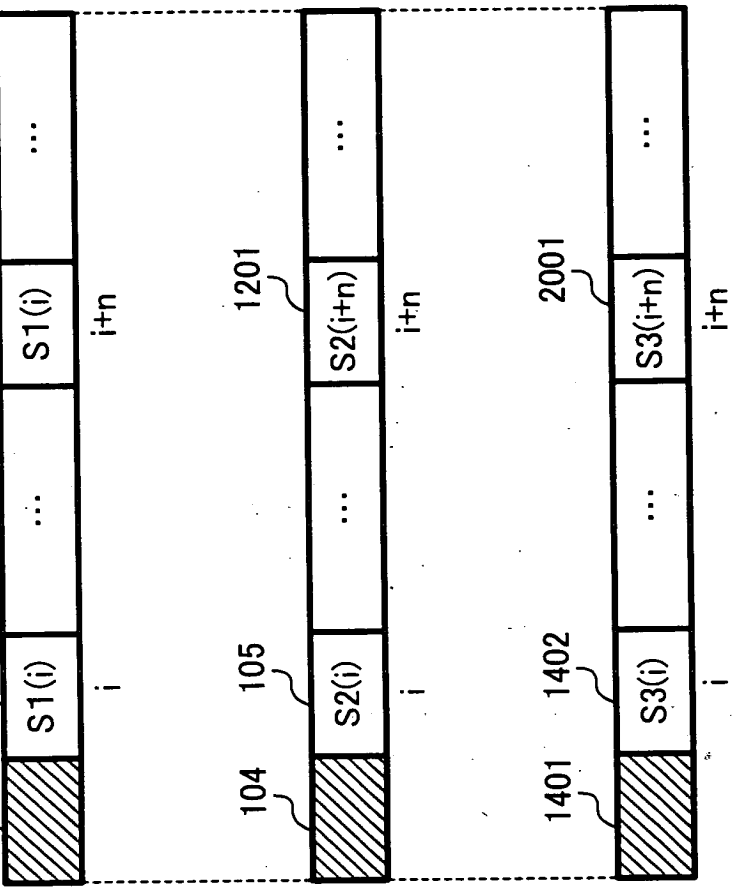

MODULATED SIGNAL A
FRAME CONFIGURATION
MODULATED SIGNAL B
FRAME CONFIGURATION
MODULATED SIGNAL C
FRAME CONFIGURATION
101
102
103
104
105
1201
1401
1402
2001
S1(i)
S2(i)
S2(i+n)
S3(i)
S3(i+n)
i
i+n
TIME

FIG.21

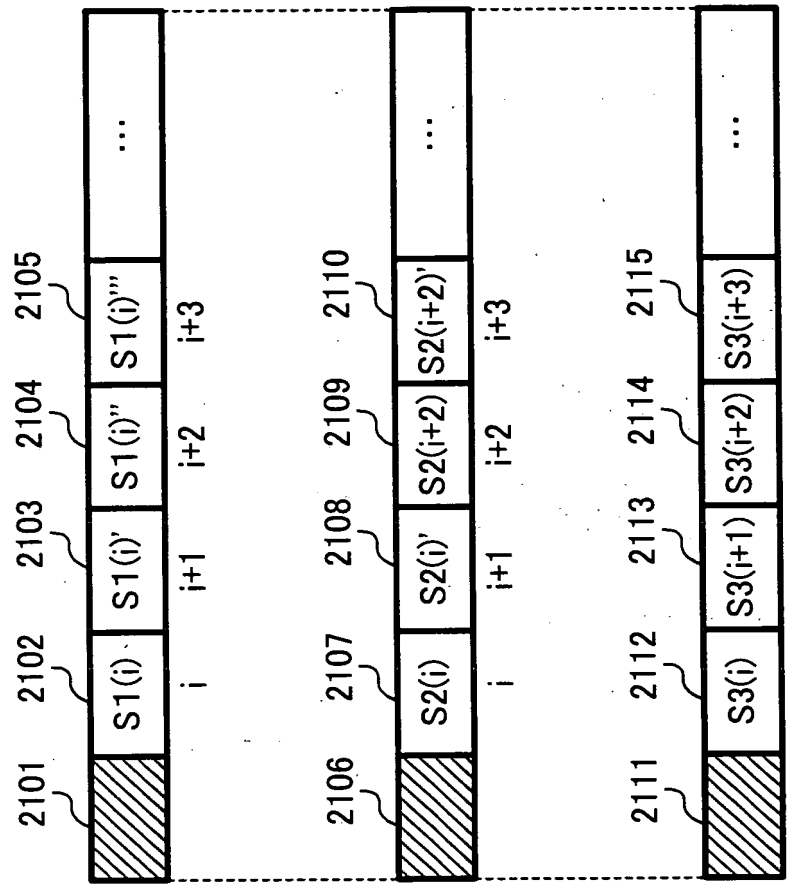

MODULATED SIGNAL A FRAME CONFIGURATION
MODULATED SIGNAL B FRAME CONFIGURATION
MODULATED SIGNAL C FRAME CONFIGURATION
2101
2102
2103
2104
2105
2106
2107
2108
2109
2110
2111
2112
2113
2114
2115
S1(i)
S1(i)'
S1(i)''
S1(i)'''
S2(i)
S2(i)'
S2(i+1)
S2(i+2)'
S3(i)
S3(i+1)
S3(i+2)
S3(i+3)
...
i
i+1
i+2
i+3
TIME

FIG.22

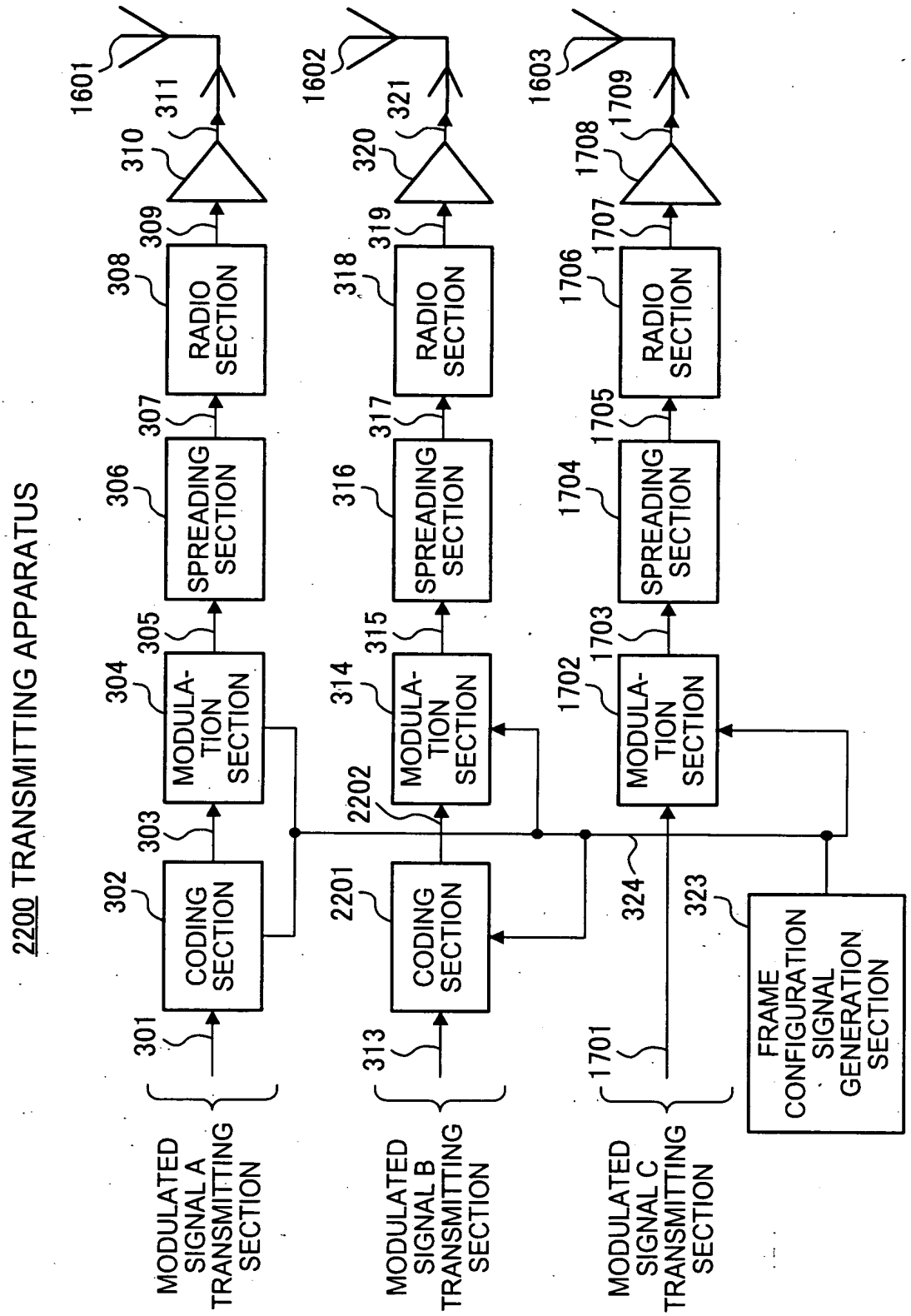

2200 TRANSMITTING APPARATUS
MODULATED SIGNAL A TRANSMITTING SECTION
MODULATED SIGNAL B TRANSMITTING SECTION
MODULATED SIGNAL C TRANSMITTING SECTION
CODING SECTION
MODULATION SECTION
SPREADING SECTION
RADIO SECTION
FRAME CONFIGURATION SIGNAL GENERATION SECTION
301
302
303
304
305
306
307
308
309
310
311
313
314
315
316
317
318
319
320
321
1601
1602
1603
1701
1702
1703
1704
1705
1706
1707
1708
1709
2201
2202
323
324

FIG.23

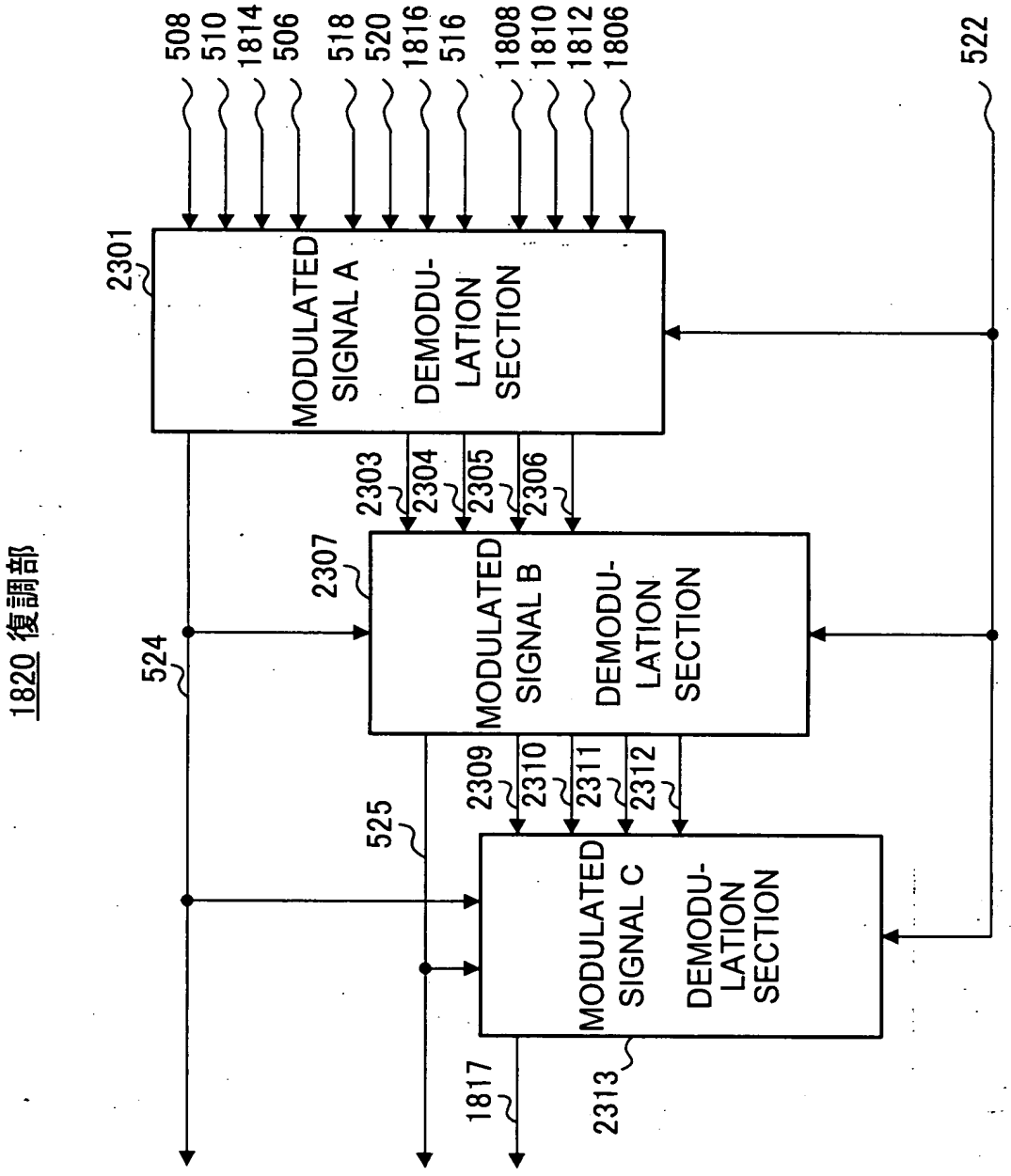

1820 復調部
508
510
1814
506
518
520
1816
516
1808
1810
1812
1806
522
2301
MODULATED SIGNAL A
DEMODU-LATION SECTION
2303
2304
2305
2306
2307
MODULATED SIGNAL B
DEMODU-LATION SECTION
524
2309
2310
2311
2312
525
MODULATED SIGNAL C
DEMODU-LATION SECTION
1817
2313

FIG.24

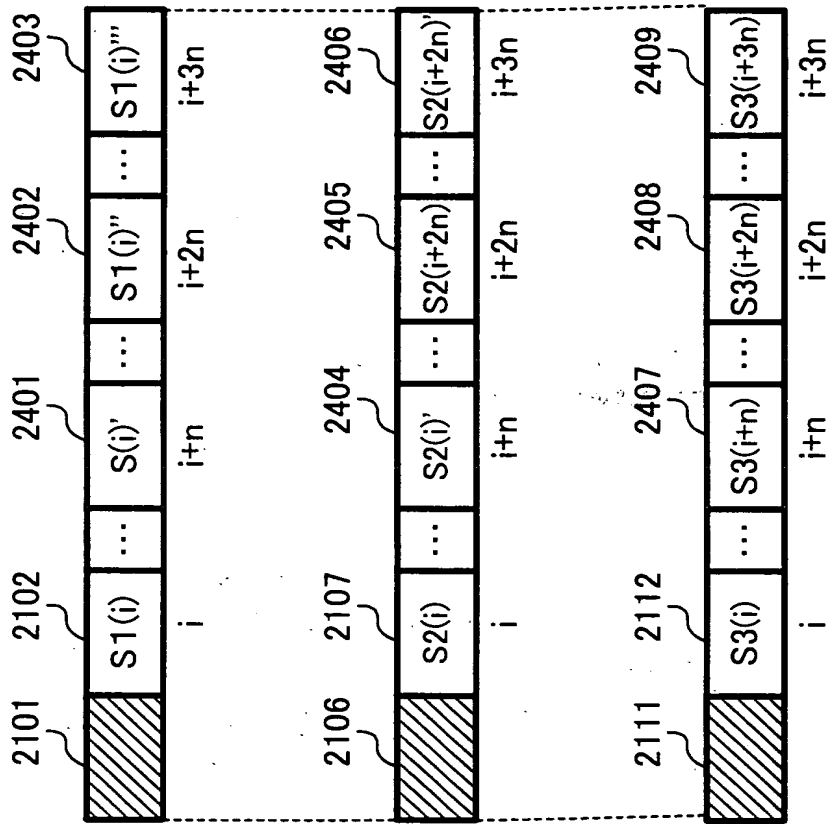

MODULATED SIGNAL A FRAME CONFIGURATION
MODULATED SIGNAL B FRAME CONFIGURATION
MODULATED SIGNAL C FRAME CONFIGURATION
2101
2102
2401
2402
2403
2106
2107
2404
2405
2406
2111
2112
2407
2408
2409
S1(i)
S(i)'
S1(i)''
S1(i)'''
S2(i)
S2(i)'
S2(i+2n)
S2(i+2n)'
S3(i)
S3(i+n)
S3(i+2n)
S3(i+3n)
i
i+n
i+2n
i+3n
TIME

FIG.25

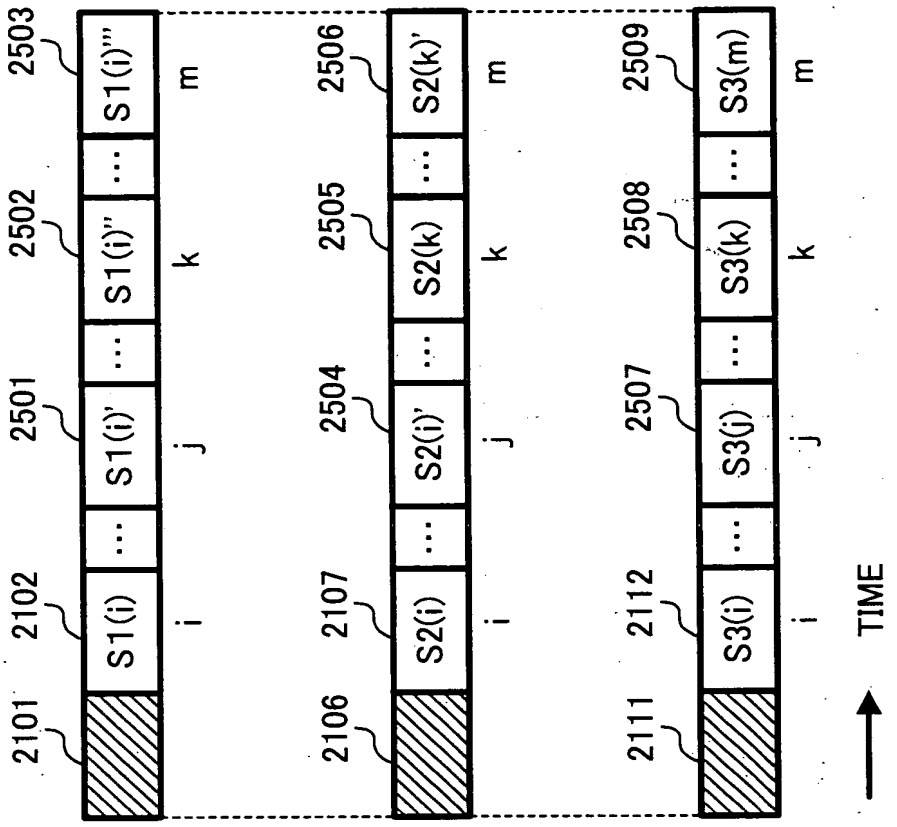

MODULATED SIGNAL A FRAME CONFIGURATION
MODULATED SIGNAL B FRAME CONFIGURATION
MODULATED SIGNAL C FRAME CONFIGURATION
2101
2102
2501
2502
2503
2106
2107
2504
2505
2506
2111
2112
2507
2508
2509
S1(i)
S1(i)'
S1(i)''
S1(i)'''
S2(i)
S2(i)'
S2(k)
S2(k)'
S3(i)
S3(j)
S3(k)
S3(m)
i
j
k
m
TIME

FIG.26

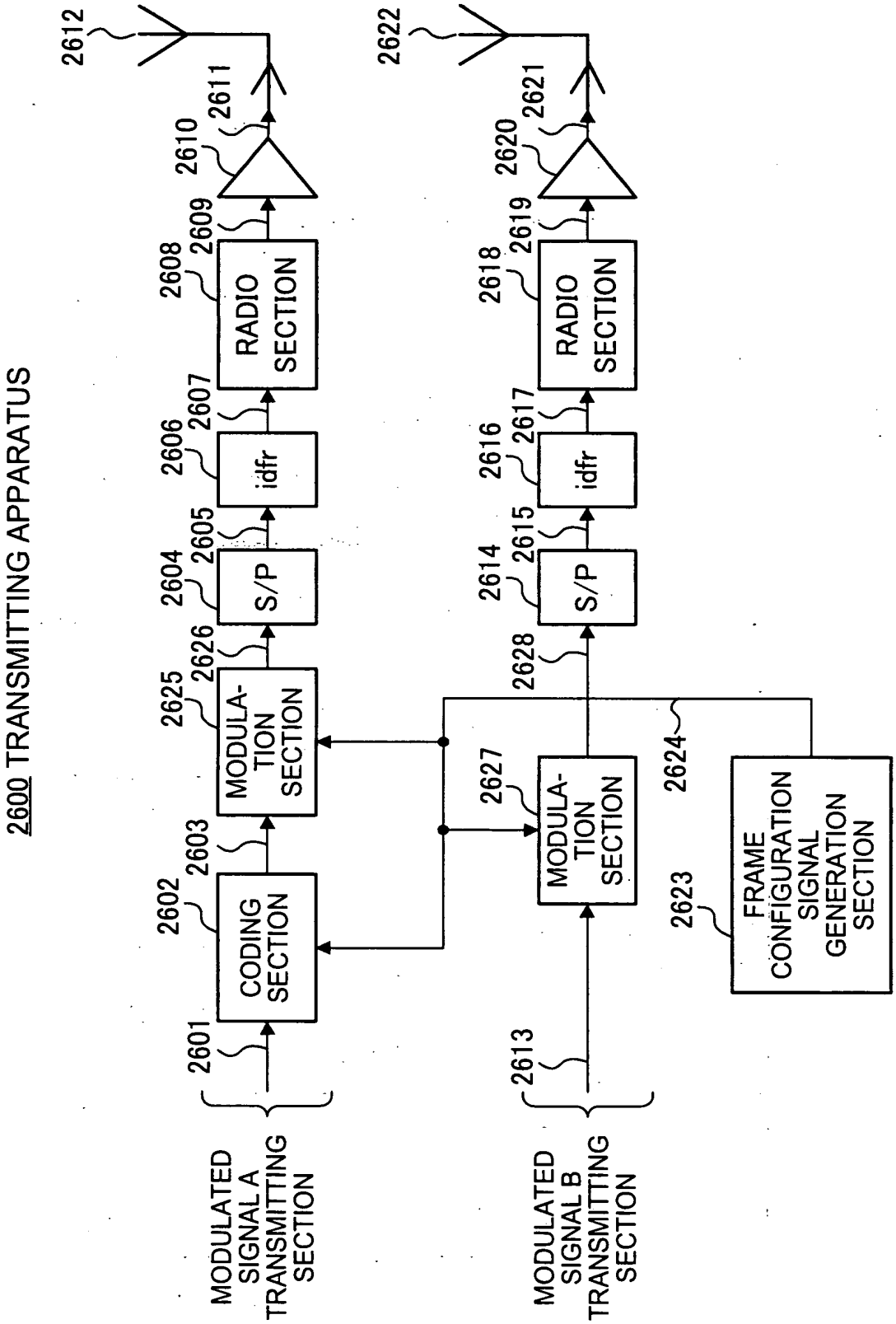

2600 TRANSMITTING APPARATUS
MODULATED SIGNAL A TRANSMITTING SECTION
MODULATED SIGNAL B TRANSMITTING SECTION
2601
2602
CODING SECTION
2603
2625
MODULA-TION SECTION
2626
2604
S/P
2605
2606
idfr
2607
2608
RADIO SECTION
2609
2610
2611
2612
2613
2614
S/P
2615
2616
idfr
2617
2618
RADIO SECTION
2619
2620
2621
2622
2627
MODULA-TION SECTION
2628
2623
FRAME CONFIGURATION SIGNAL GENERATION SECTION
2624

FIG.27

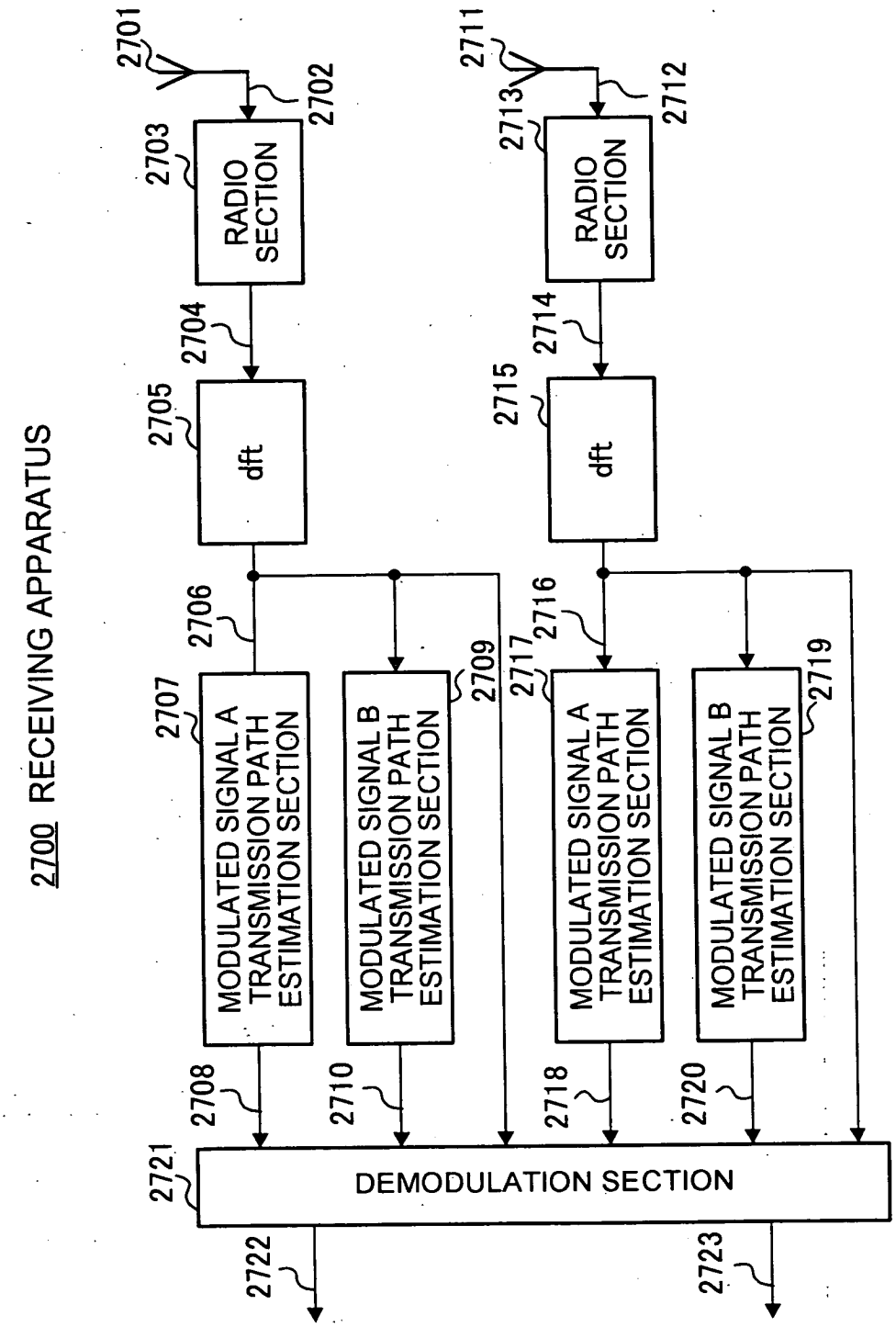

2700 RECEIVING APPARATUS
2701
2702
2703
RADIO SECTION
2704
2705
dft
2706
2707
MODULATED SIGNAL A TRANSMISSION PATH ESTIMATION SECTION
2708
2709
MODULATED SIGNAL B TRANSMISSION PATH ESTIMATION SECTION
2710
2711
2712
2713
RADIO SECTION
2714
2715
dft
2716
2717
MODULATED SIGNAL A TRANSMISSION PATH ESTIMATION SECTION
2718
2719
MODULATED SIGNAL B TRANSMISSION PATH ESTIMATION SECTION
2720
2721
DEMODULATION SECTION
2722
2723

FIG.28

FIG.29A

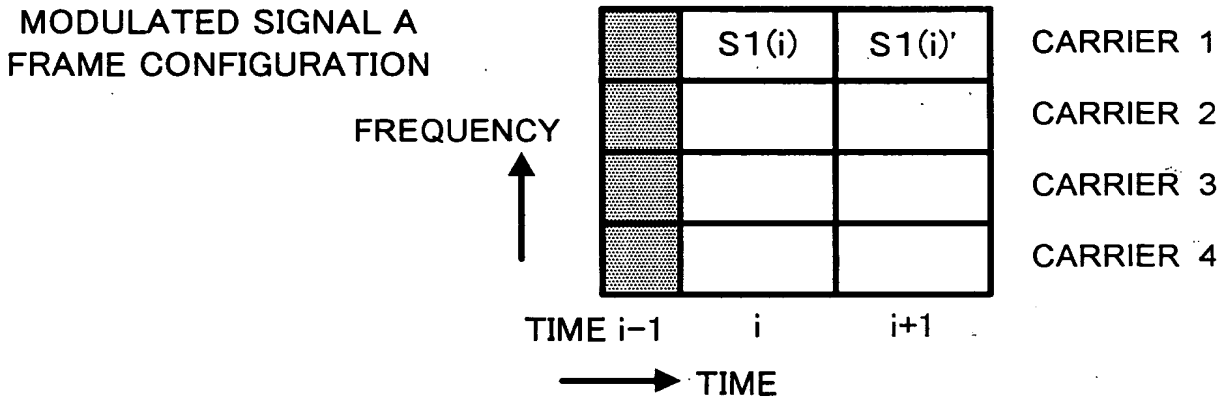
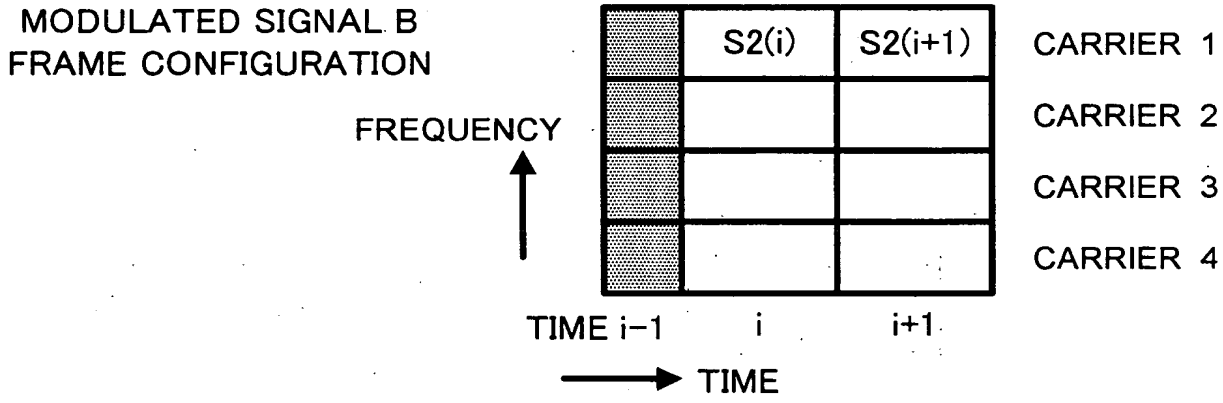


FIG.29B



2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL

2802 : DATA SYMBOL

FIG.30A

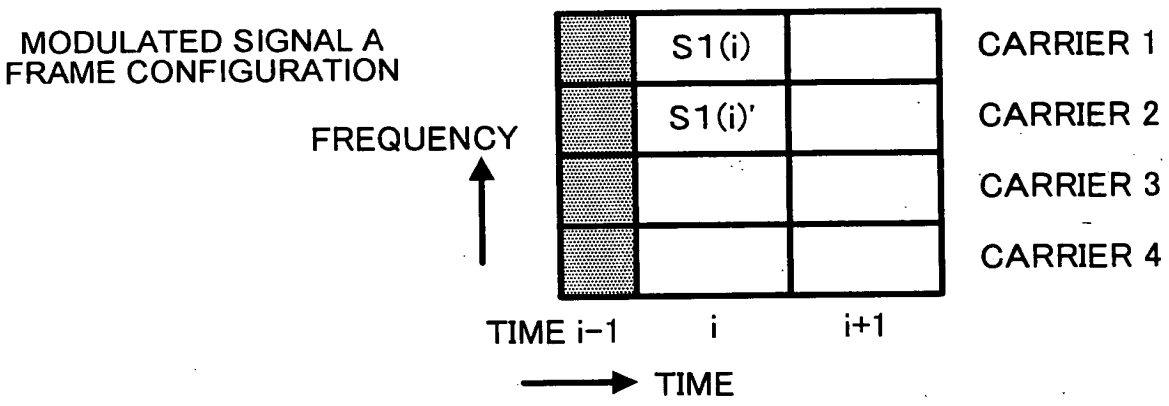
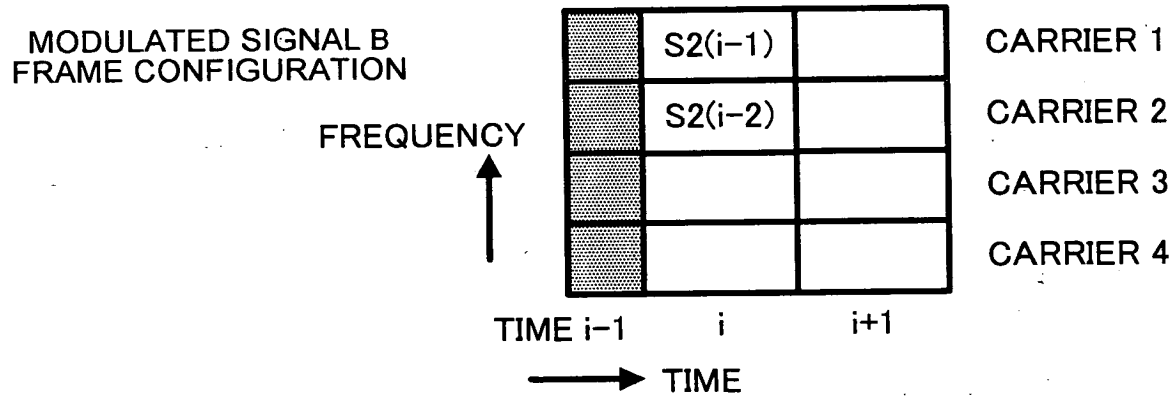


FIG.30B



2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL

2802 : DATA SYMBOL

FIG.31A

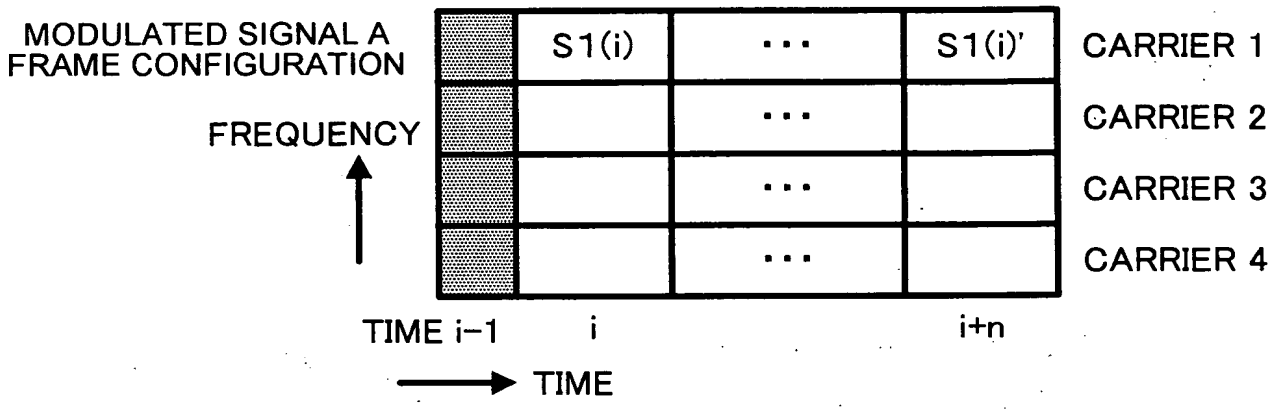
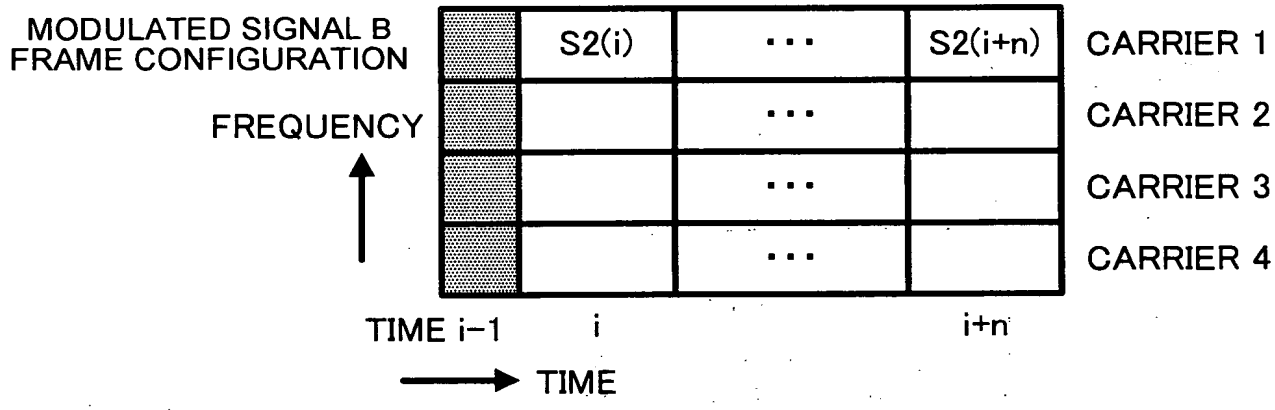


FIG.31B



2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL

2802 : DATA SYMBOL

FIG.32A

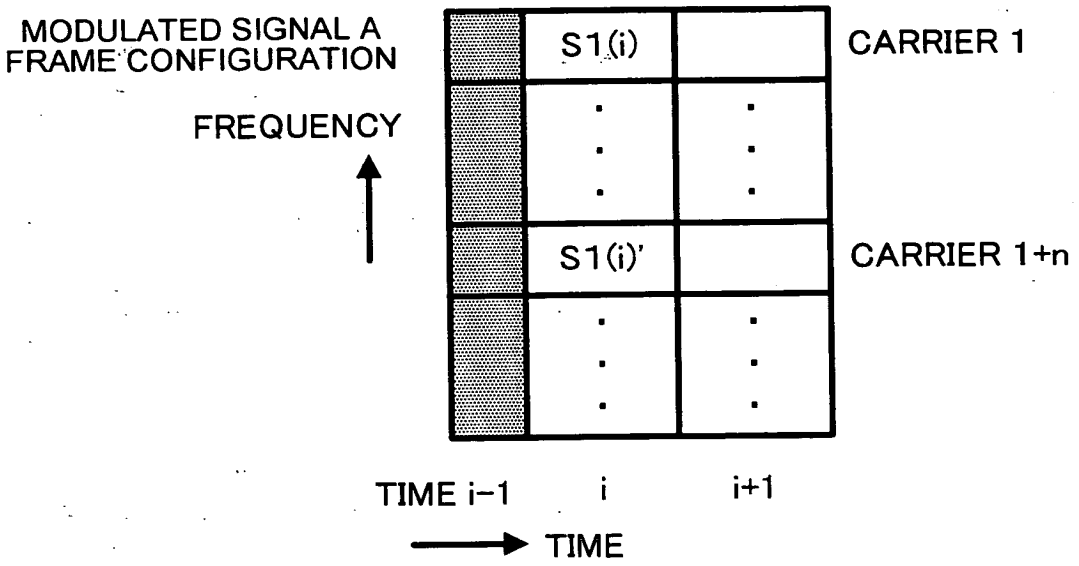
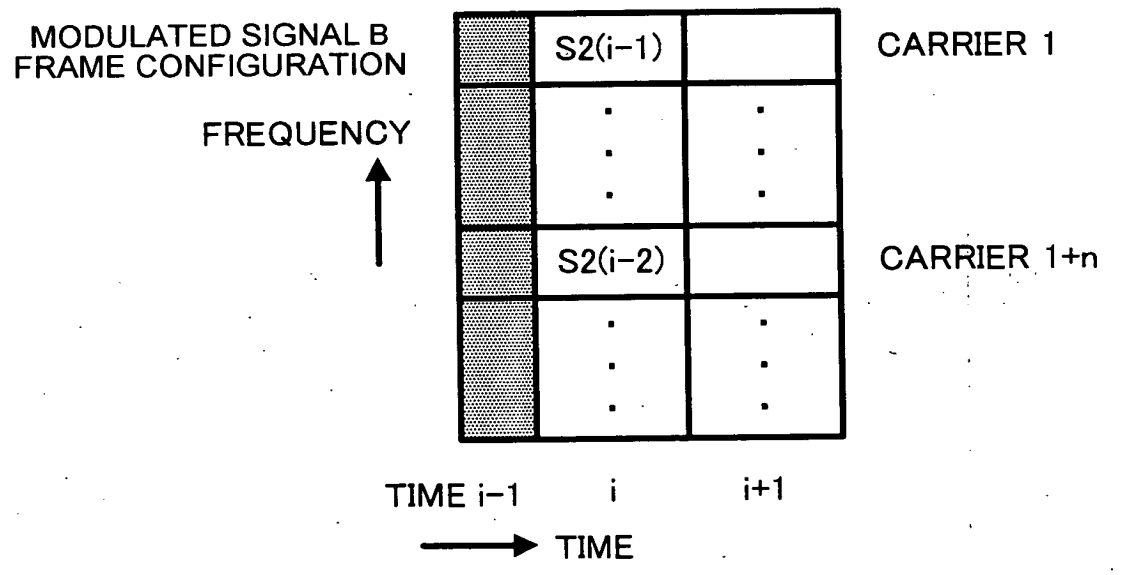


FIG.32B



2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL

2802 : DATA SYMBOL

FIG.33A

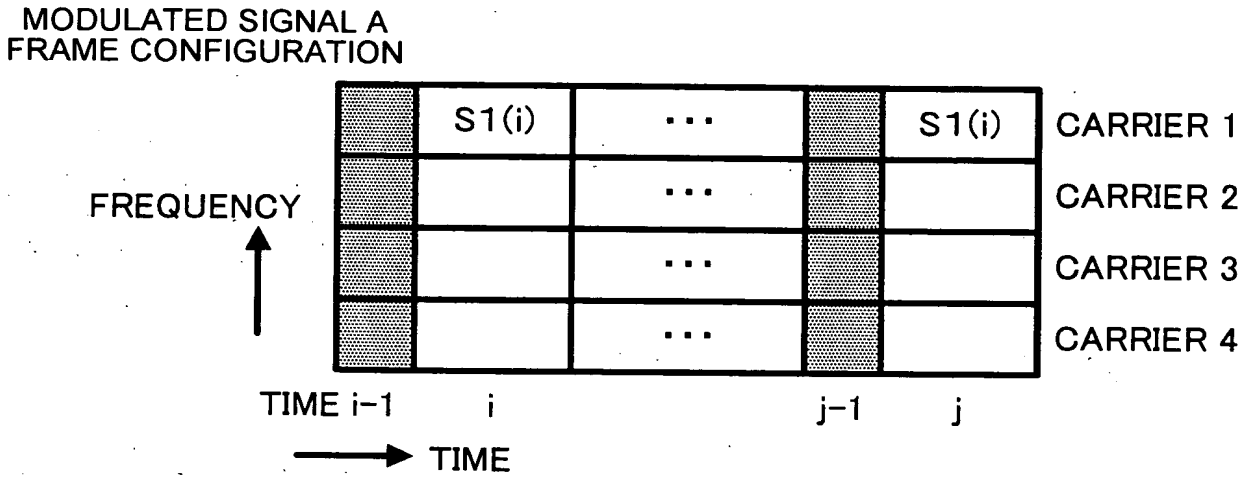
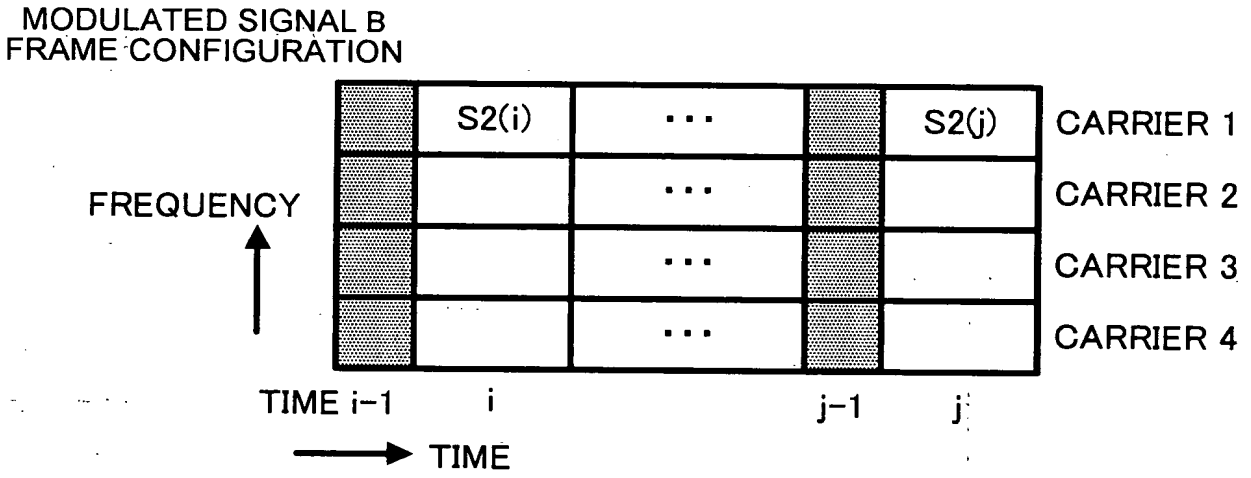


FIG.33B



2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL

2802 : DATA SYMBOL

FIG.34A

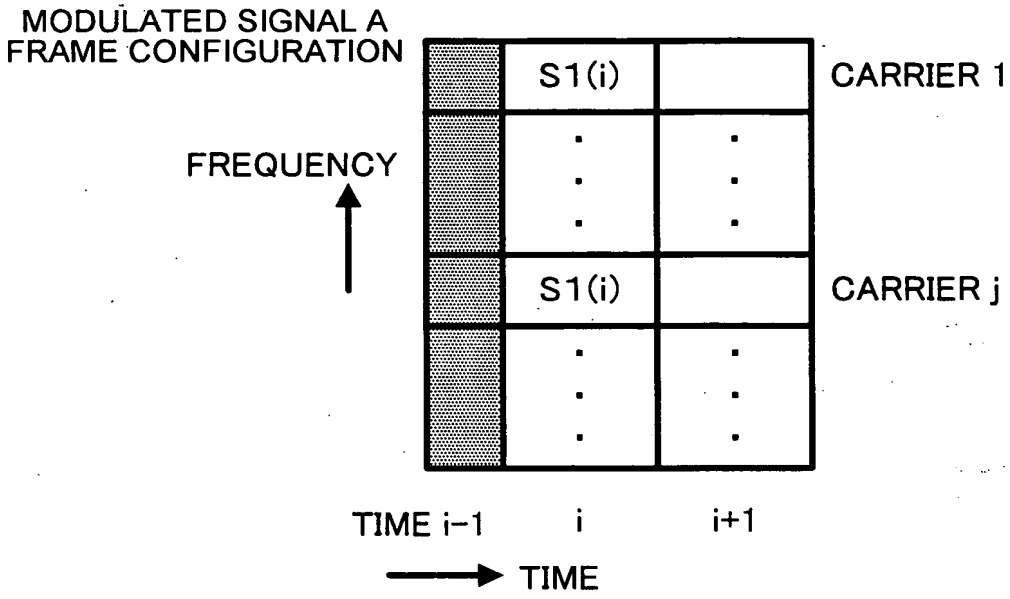
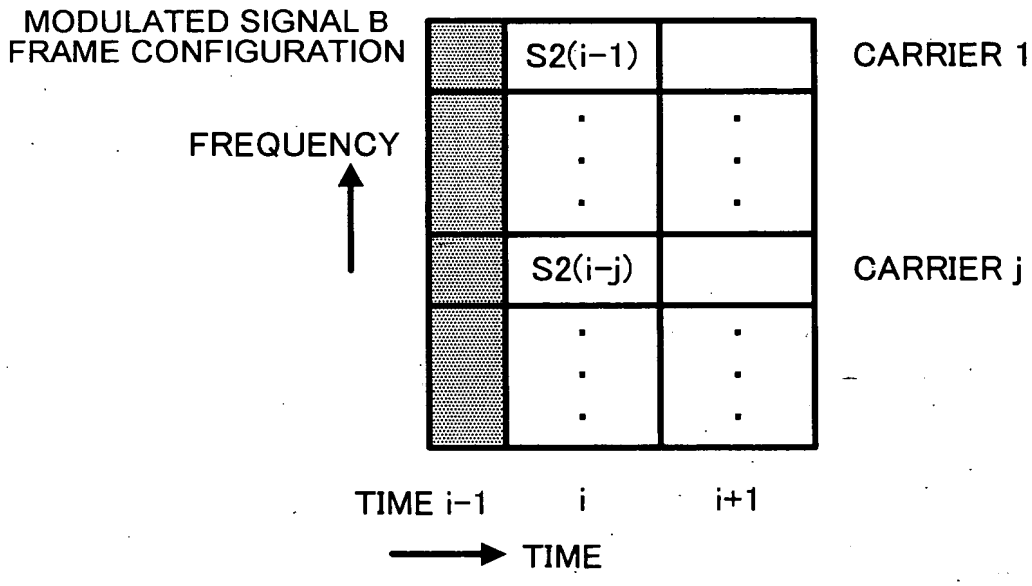


FIG.34B



2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL

2802 : DATA SYMBOL

FIG.35A

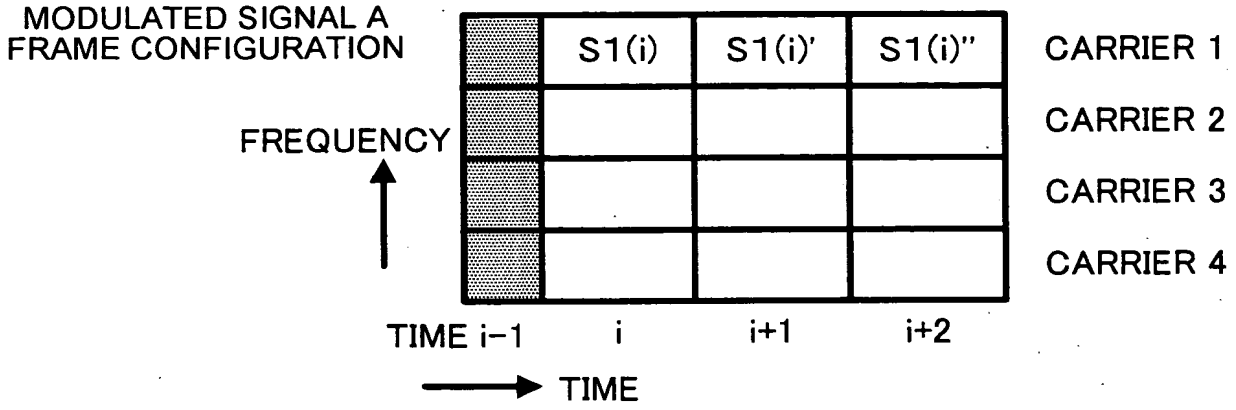
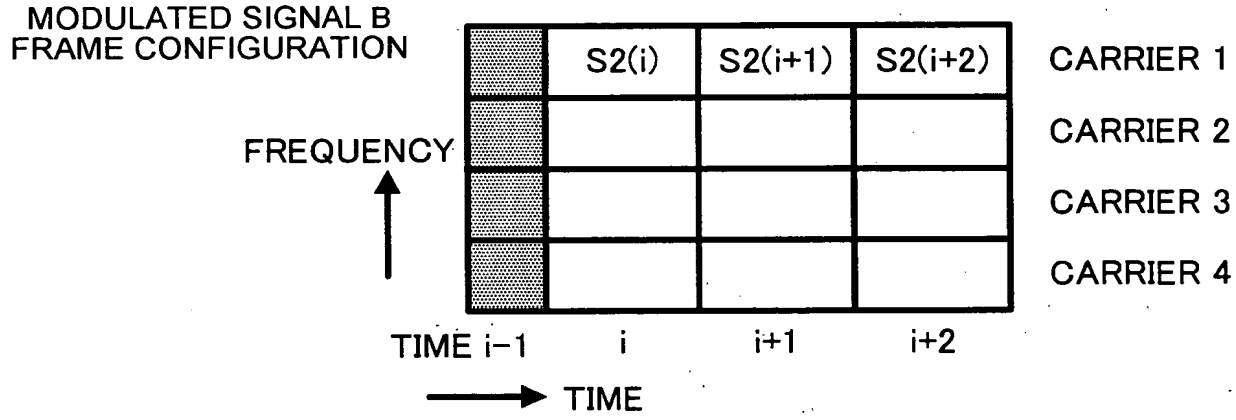


FIG.35B



2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL

2802 : DATA SYMBOL

FIG.36A

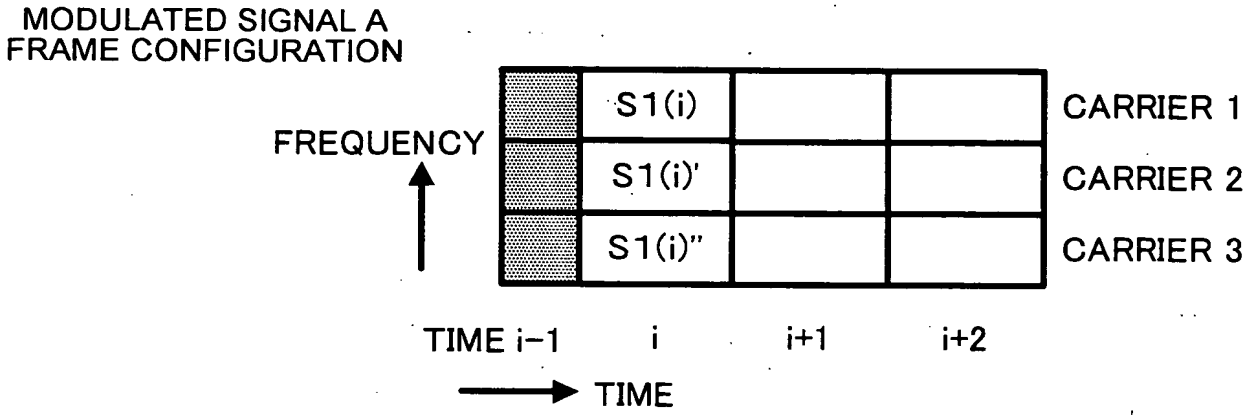
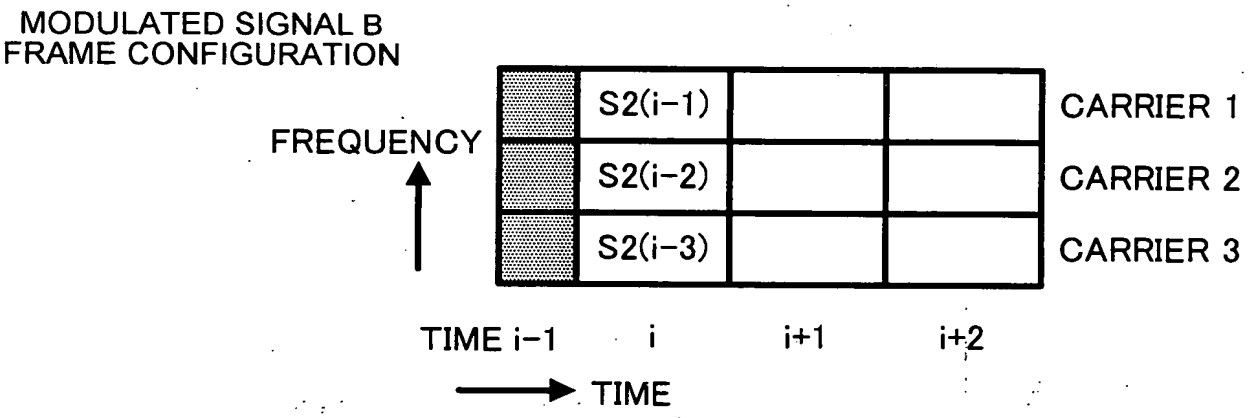


FIG.36B



2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL

2802 : DATA SYMBOL

FIG.37A

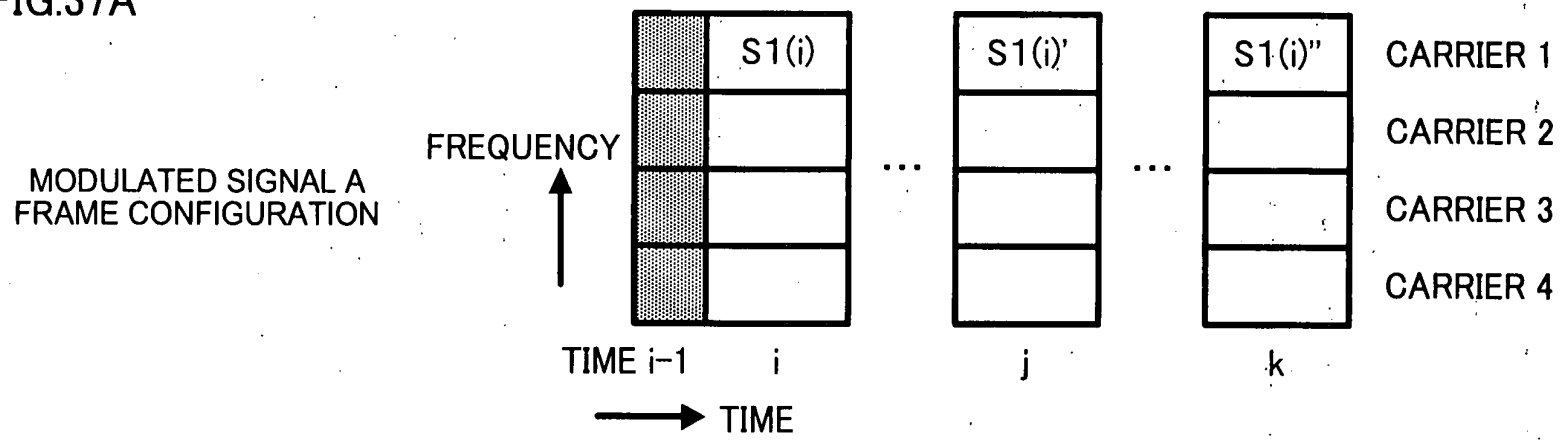
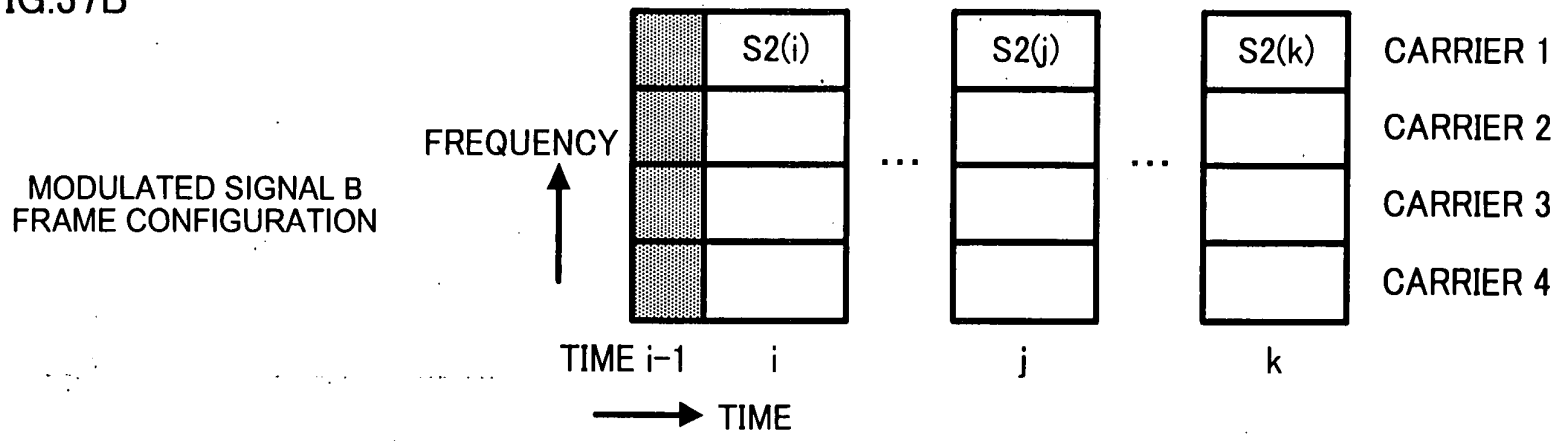


FIG.37B



2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL

2802 : DATA SYMBOL

FIG.38A

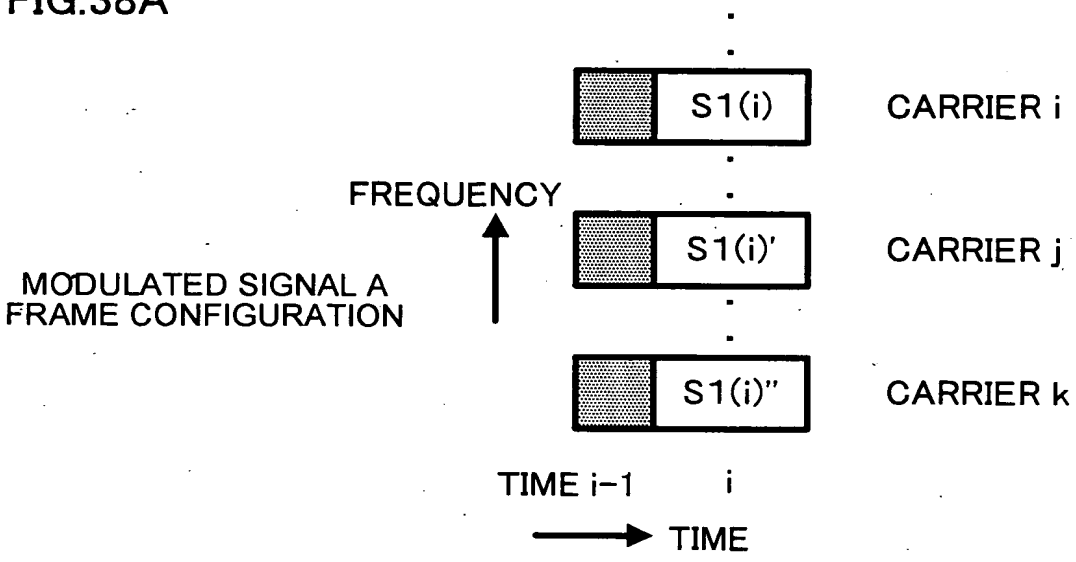
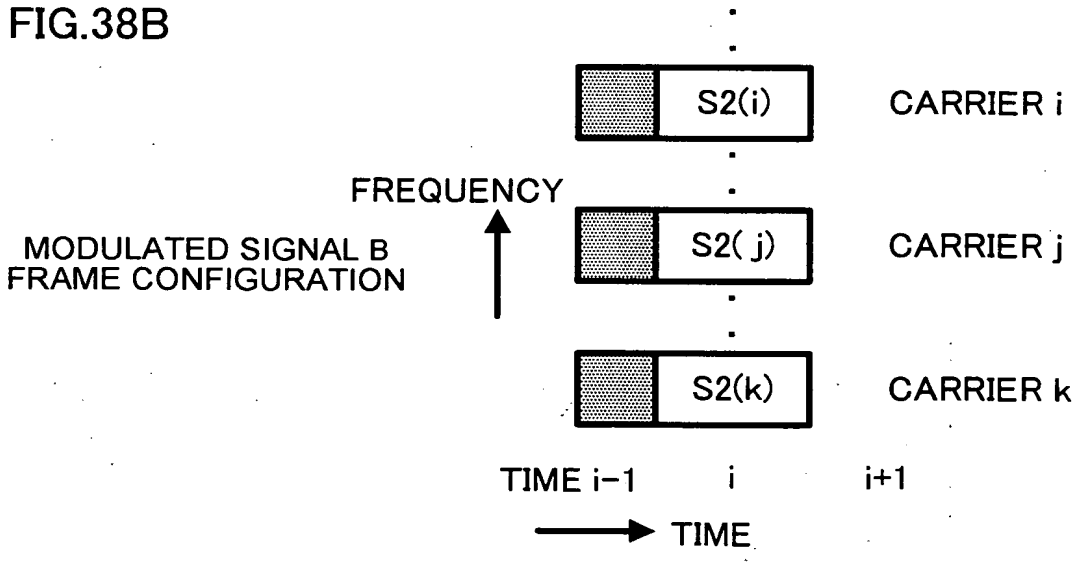


FIG.38B



2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL

2802 : DATA SYMBOL

FIG.39A

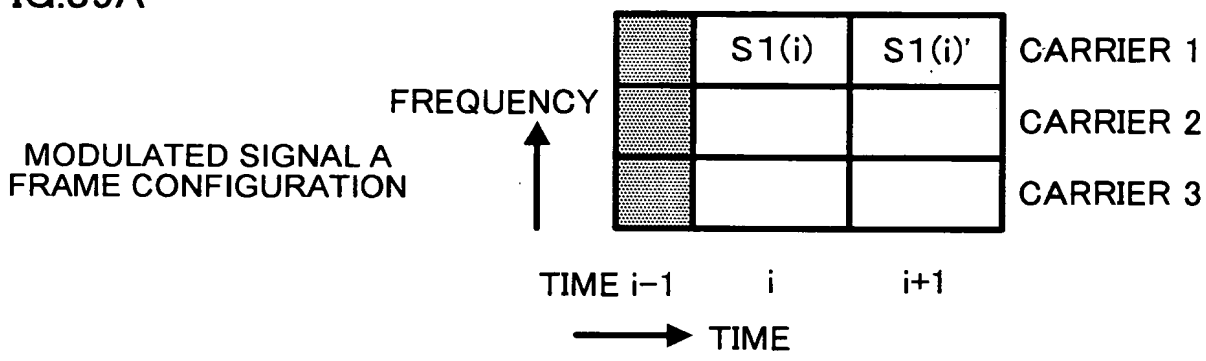


FIG.39B

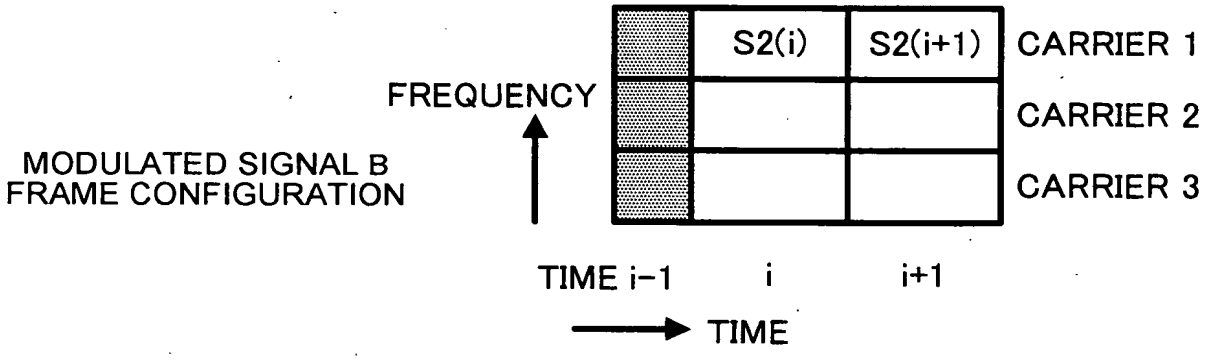
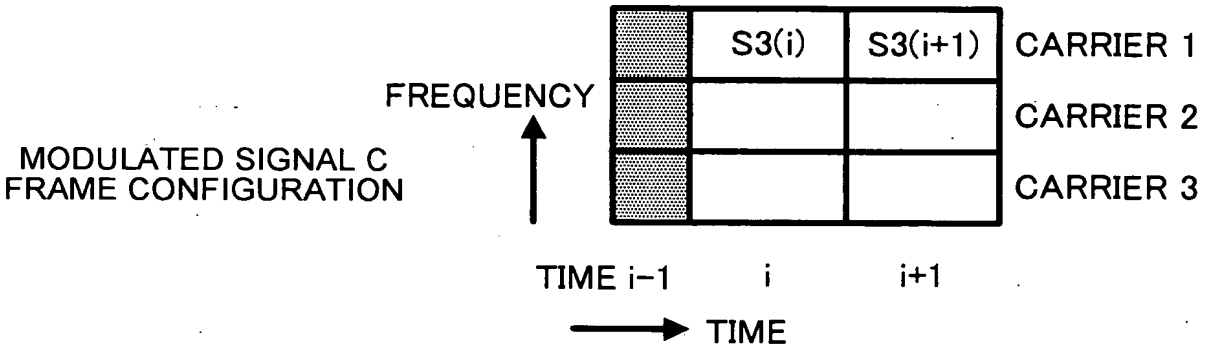


FIG.39C



2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL

2802 : DATA SYMBOL

FIG.40A

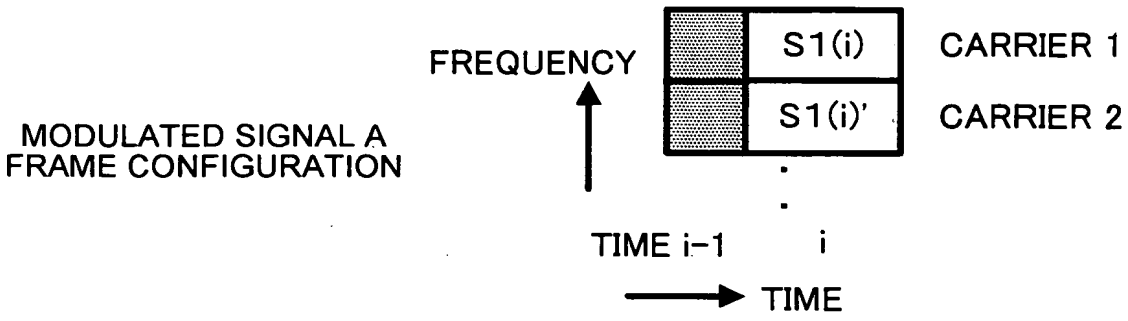


FIG.40B

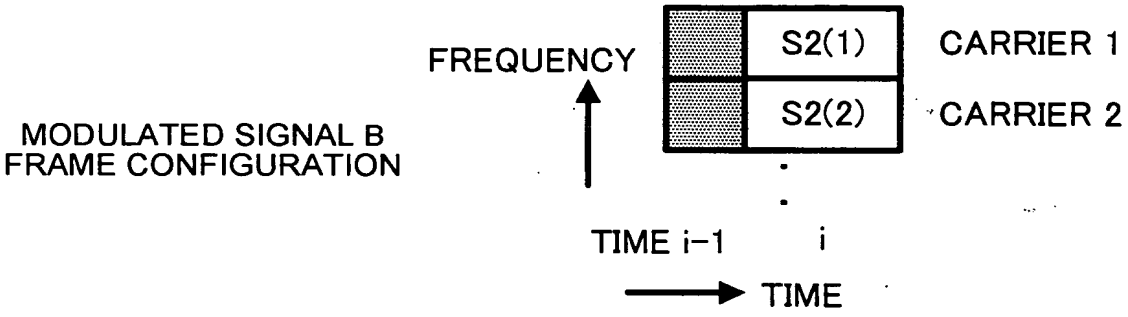
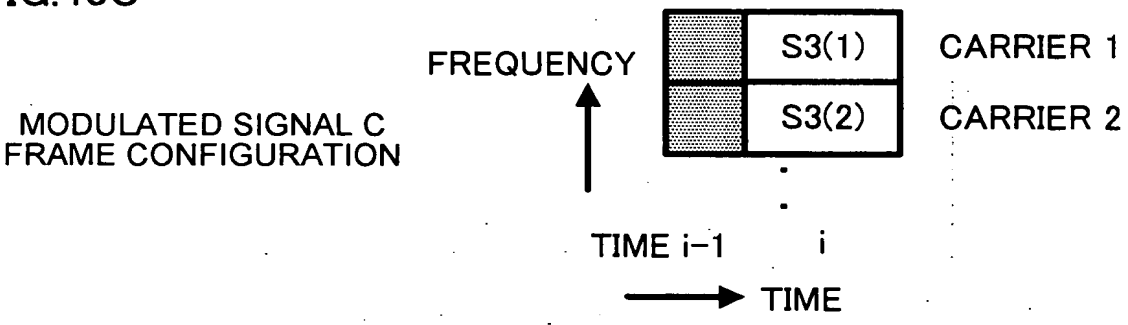


FIG.40C




2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL


2802 : DATA SYMBOL

FIG.41A

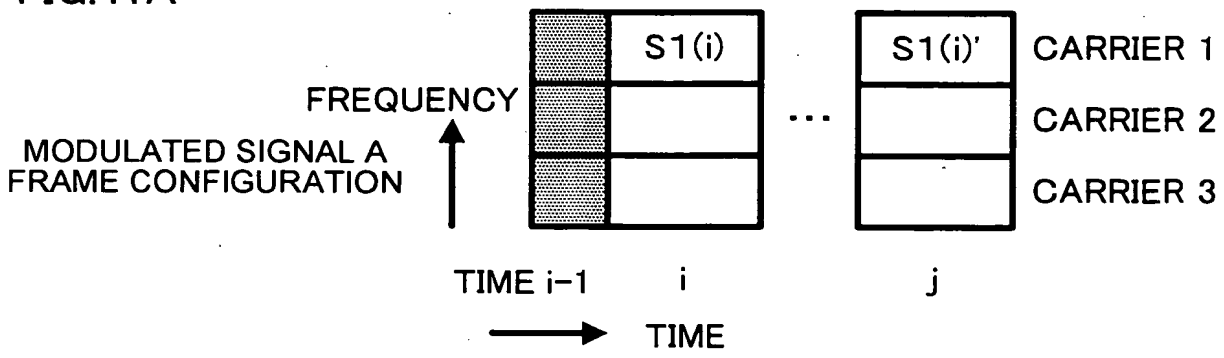


FIG.41B

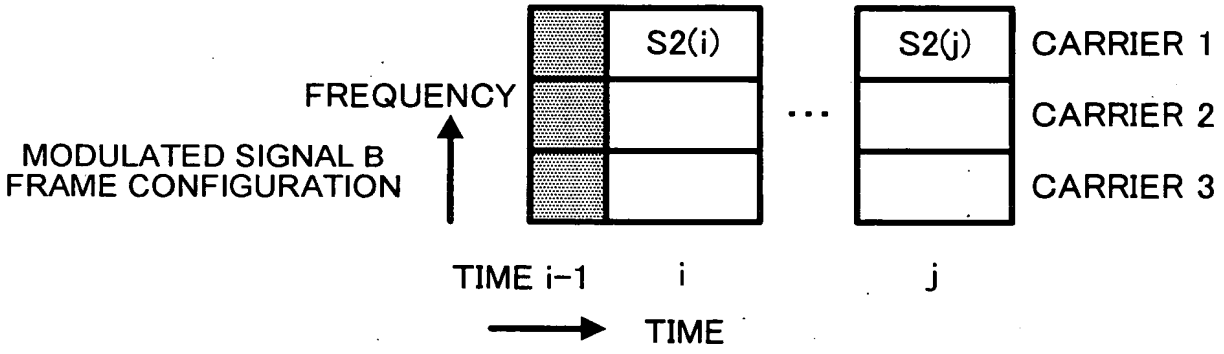
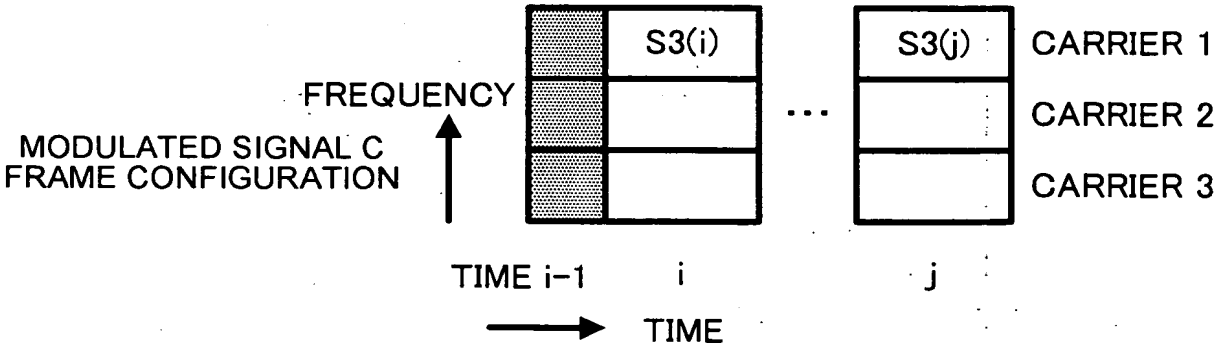


FIG.41C



2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL

2802 : DATA SYMBOL

FIG.42A

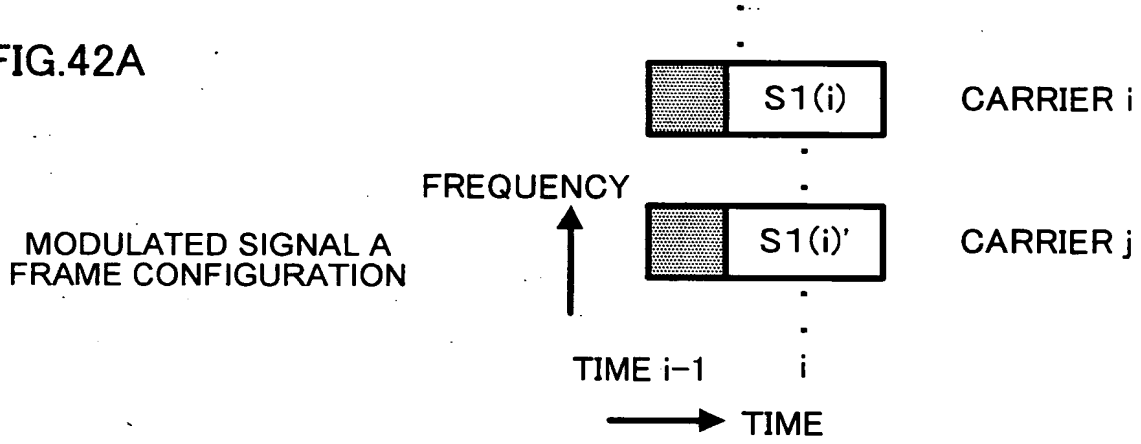


FIG.42B

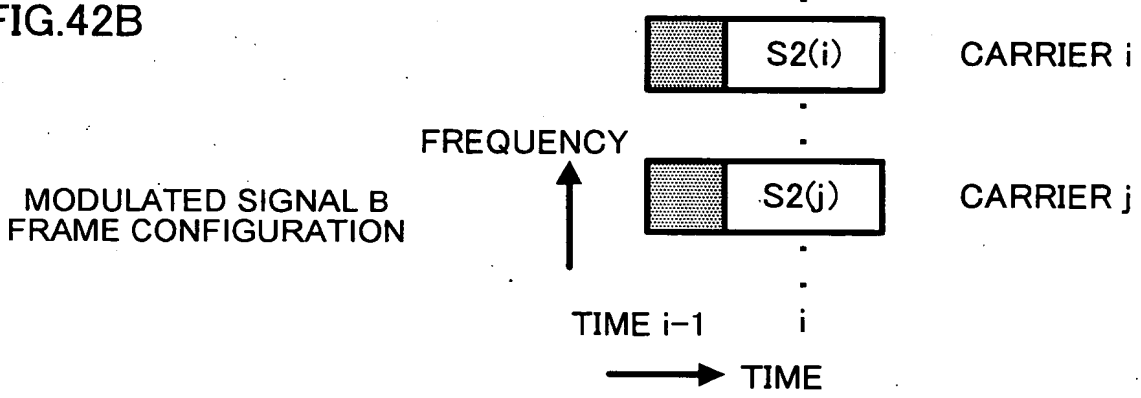
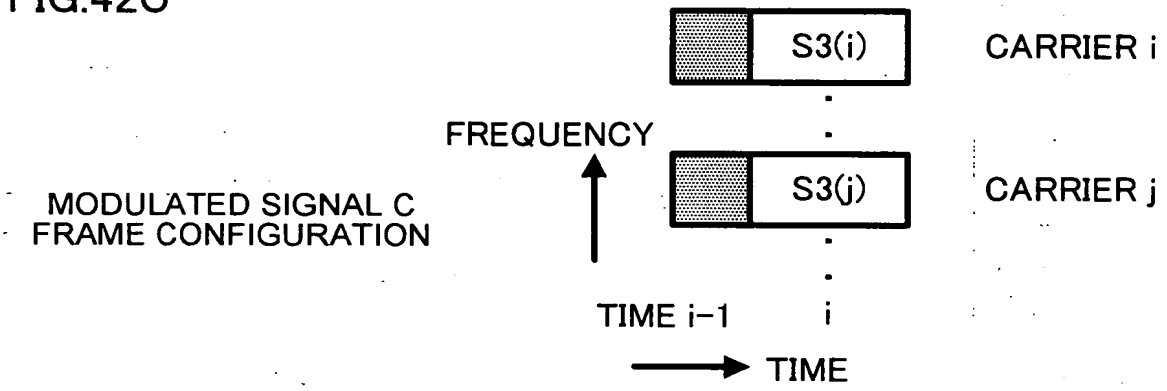


FIG.42C



2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL

2802 : DATA SYMBOL

FIG.43A

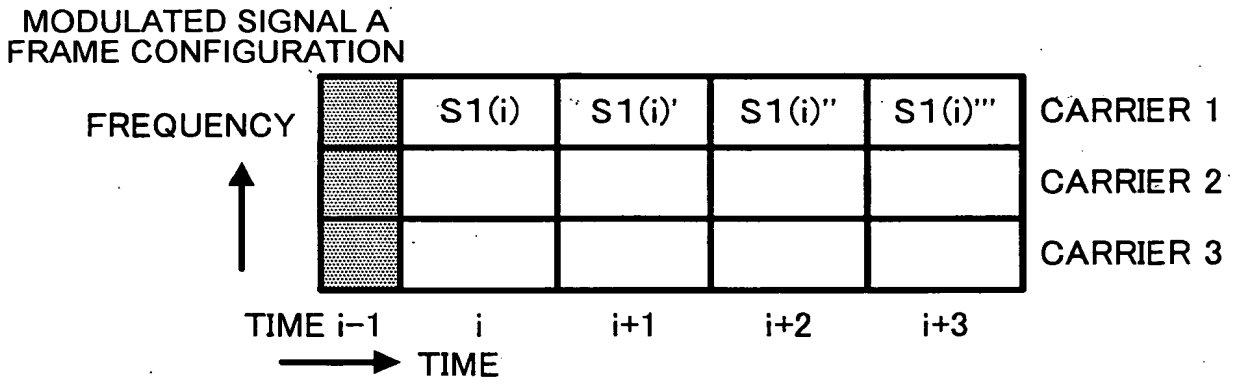


FIG.43B

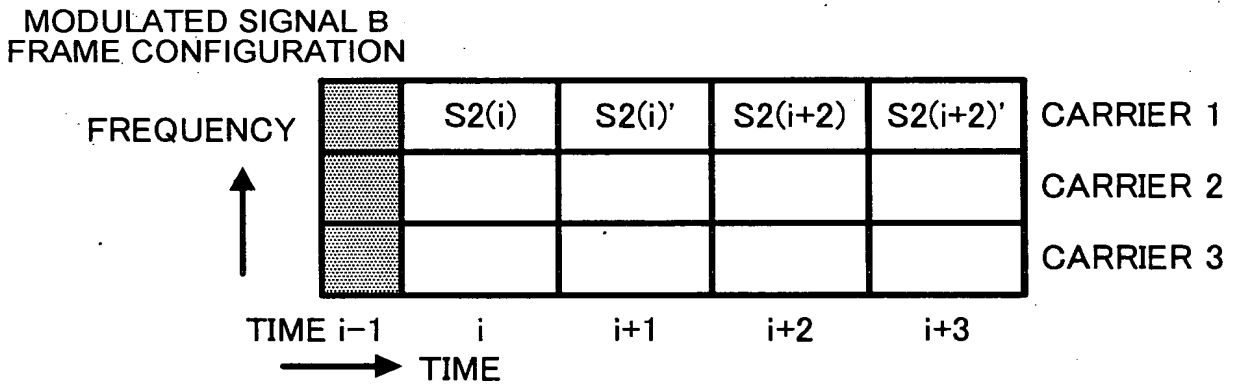
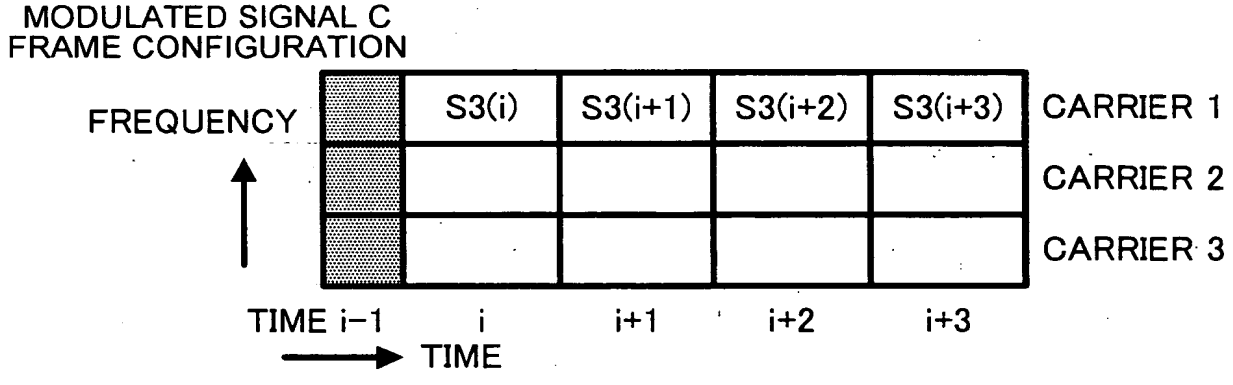


FIG.43C




2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL


2802 : DATA SYMBOL

FIG.44A

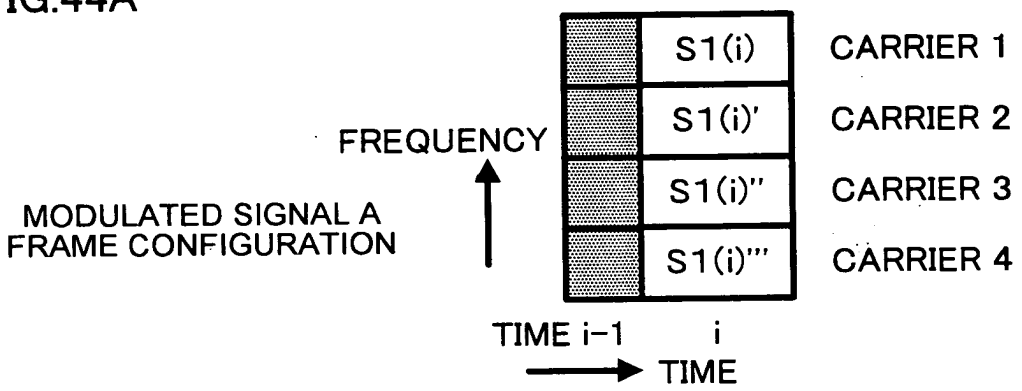


FIG.44B

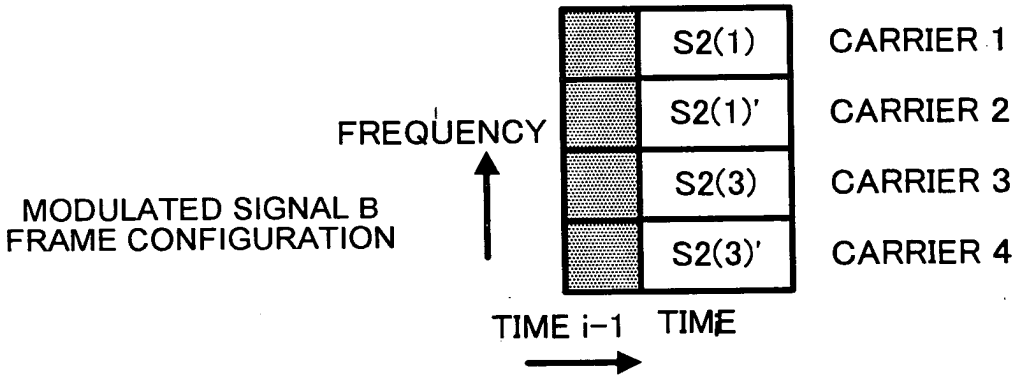
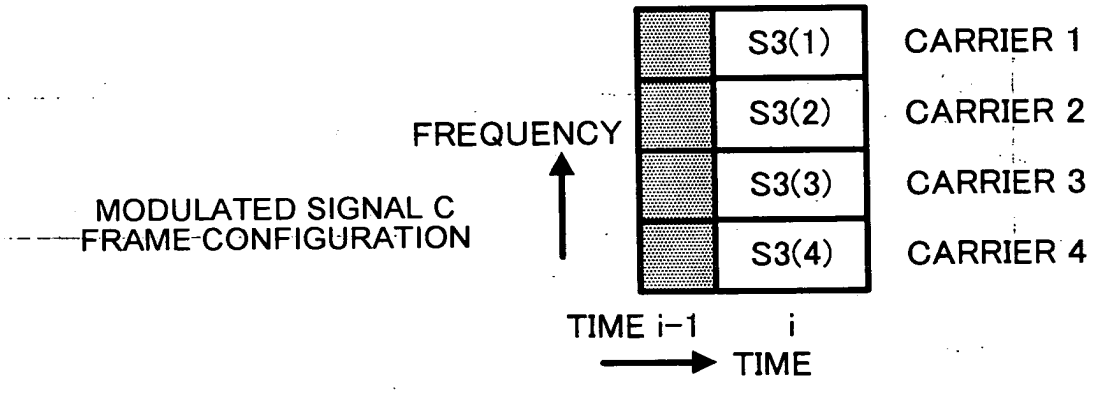


FIG.44C




2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL


2802 : DATA SYMBOL

FIG.45A

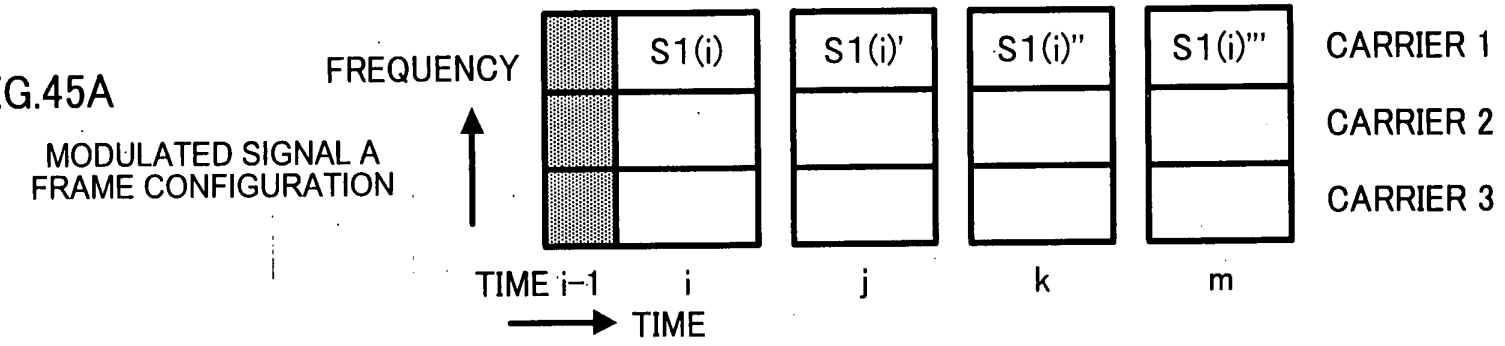


FIG.45B

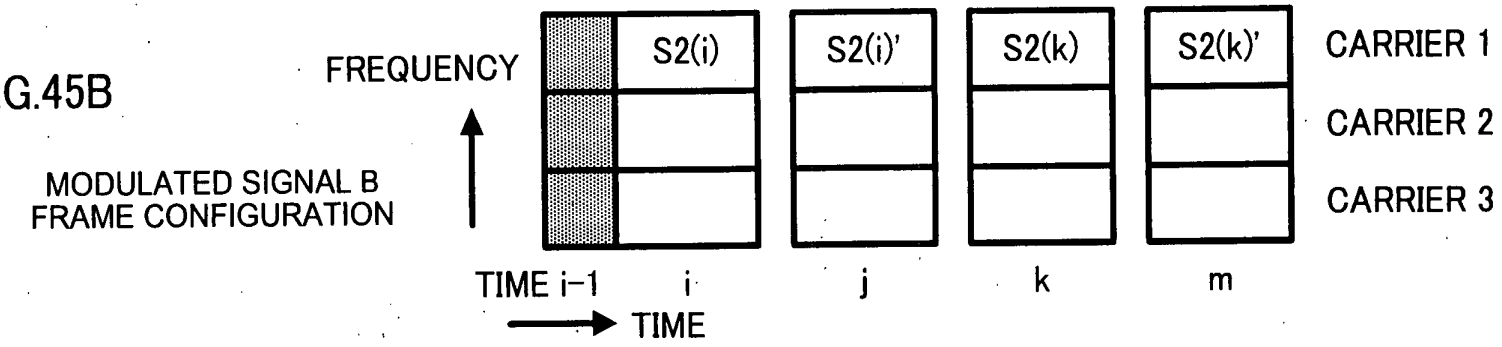
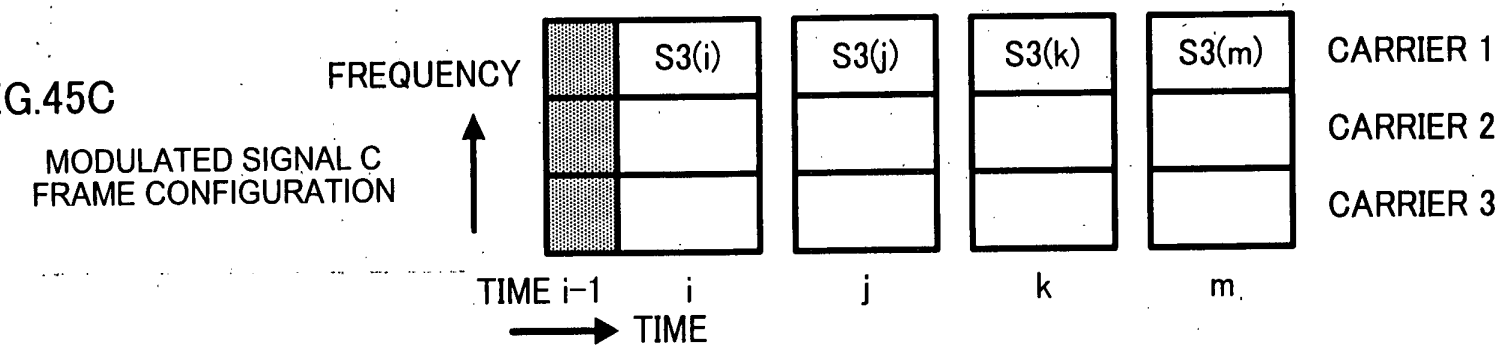


FIG.45C



2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL

2802 : DATA SYMBOL

FIG.46A

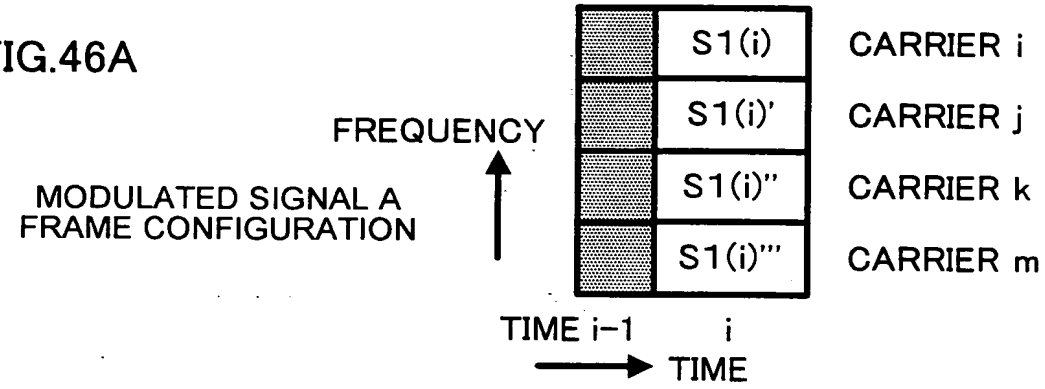


FIG.46B

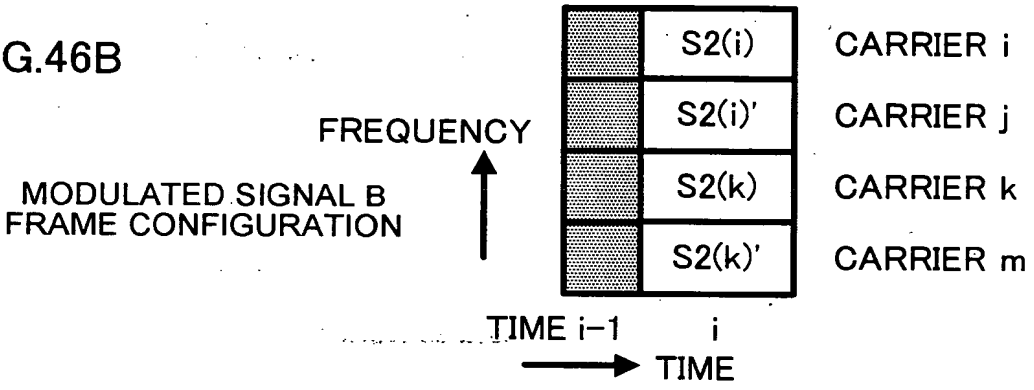
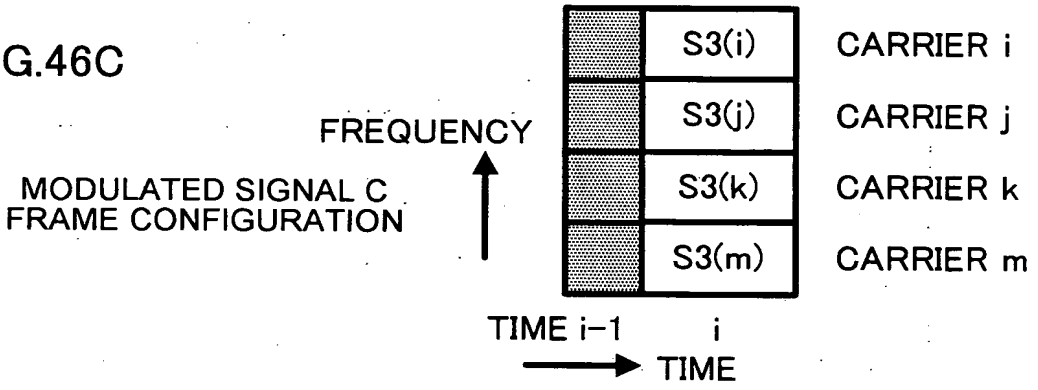


FIG.46C



2801 : RADIO WAVE PROPAGATION ENVIRONMENT ESTIMATION SYMBOL

2802 : DATA SYMBOL

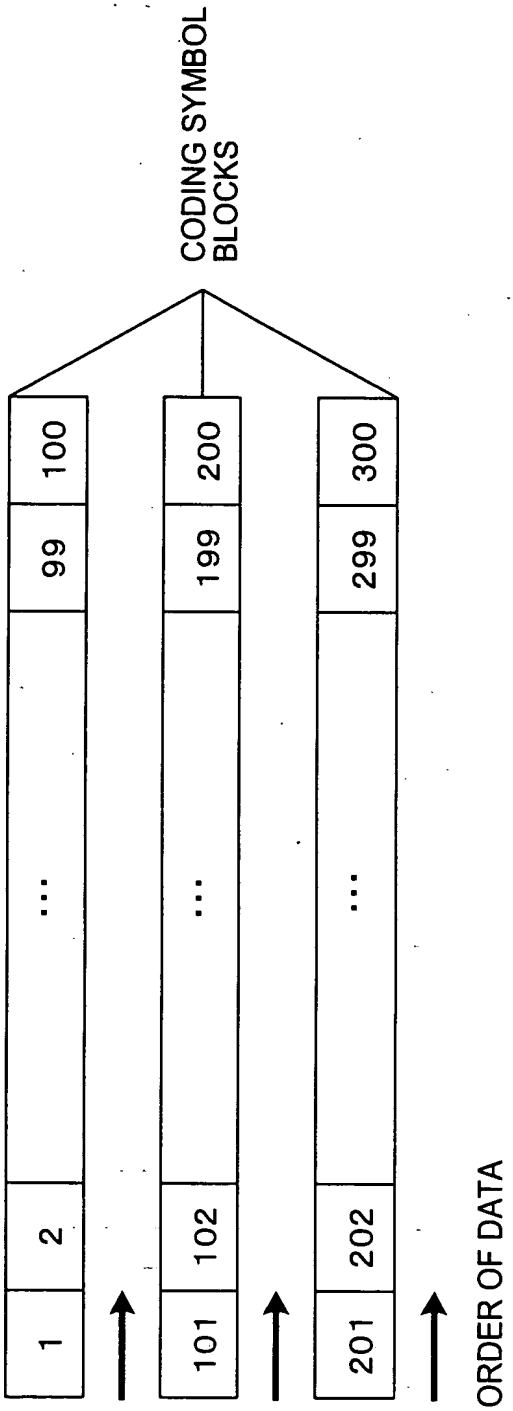


FIG.47A

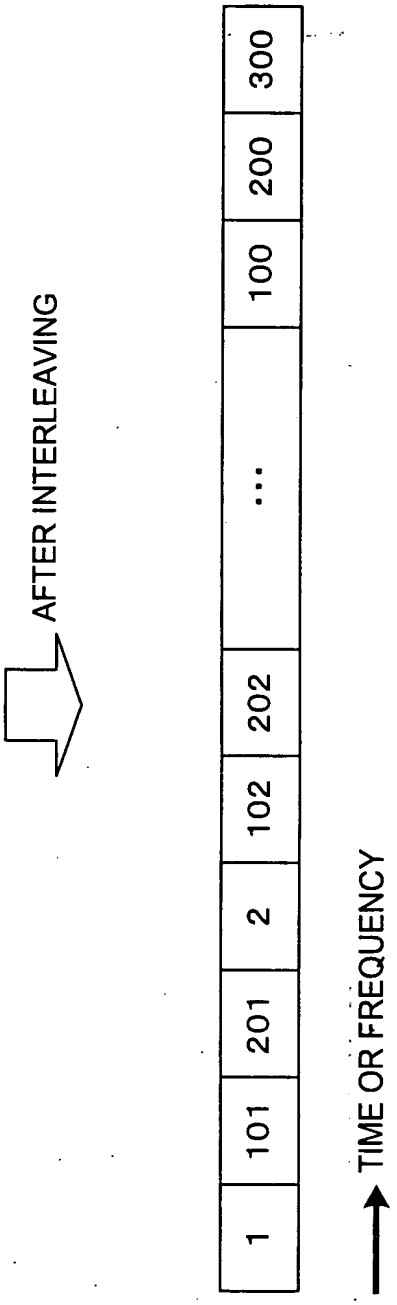


FIG.47B

FIG.48A

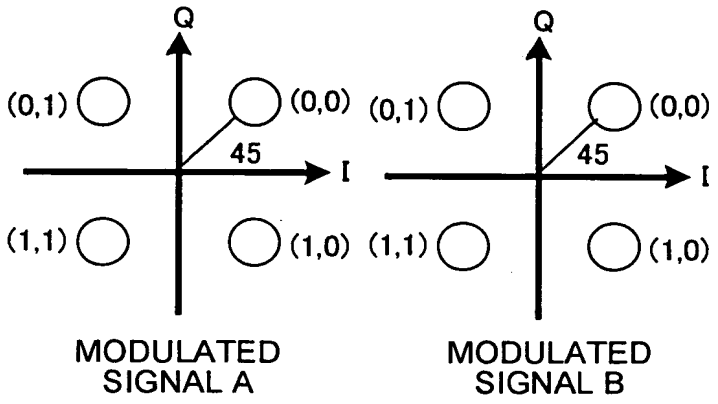


FIG.48B

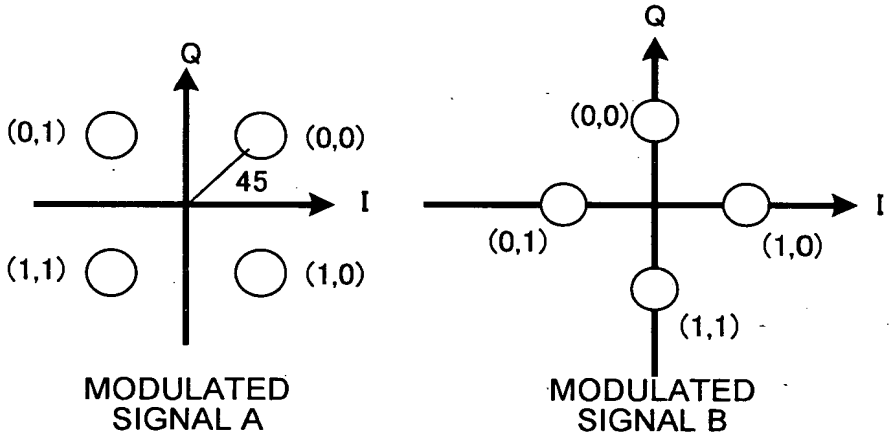
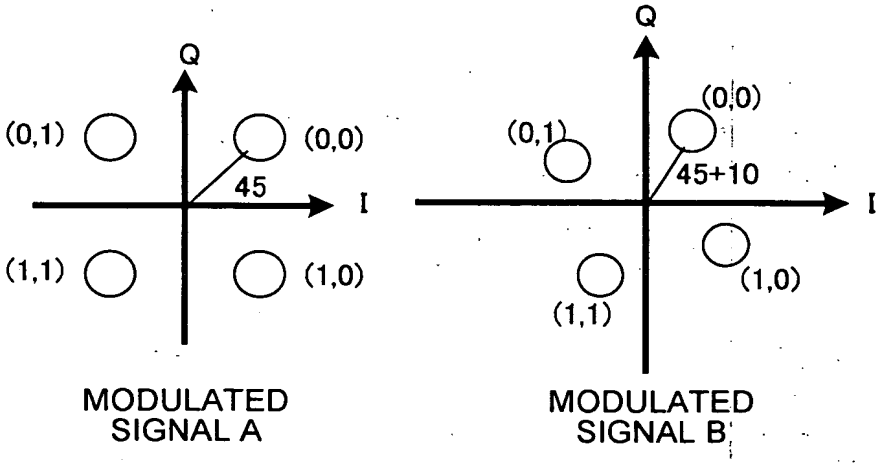


FIG.48C



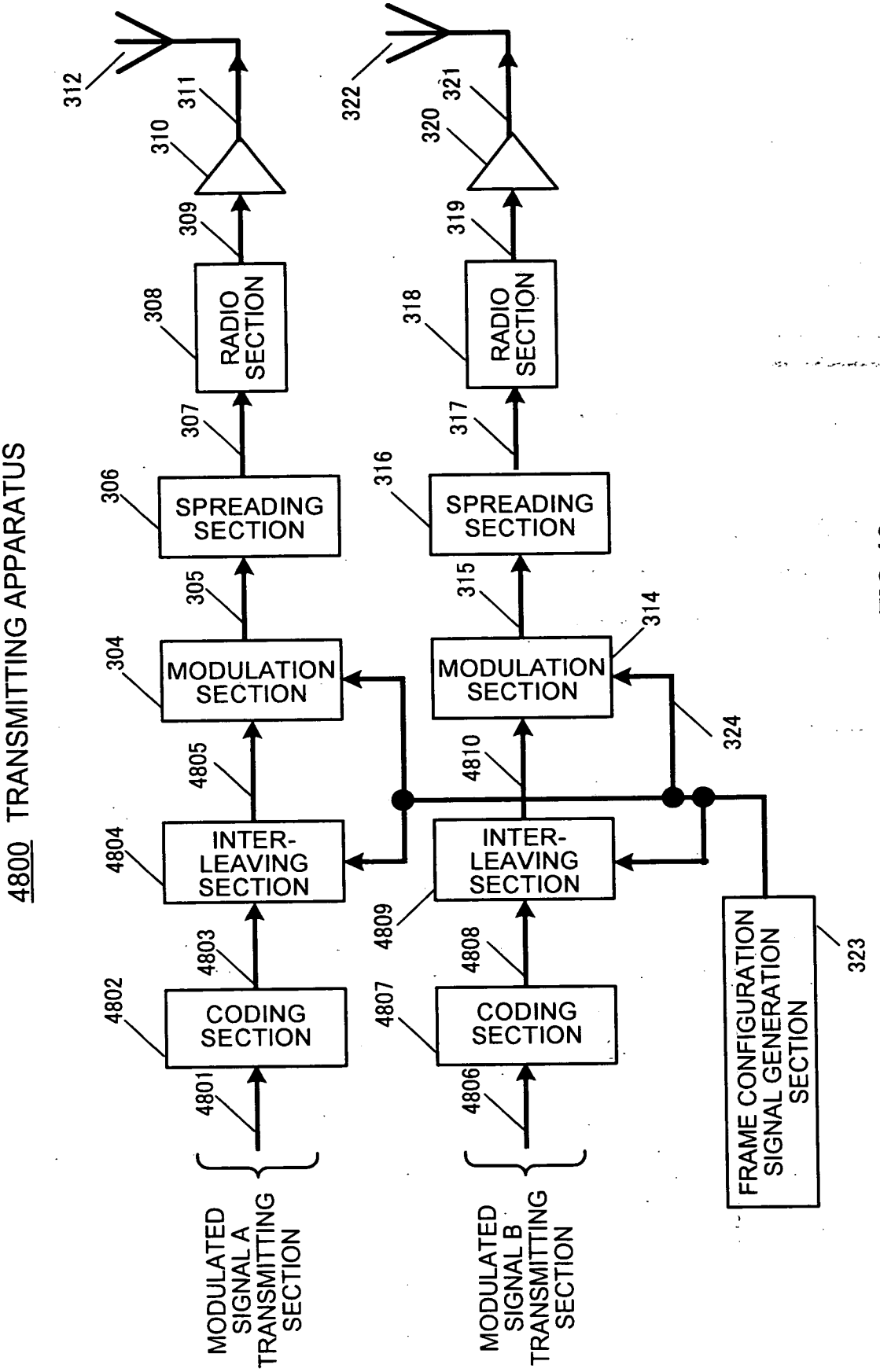

4800 TRANSMITTING APPARATUS
MODULATED SIGNAL A TRANSMITTING SECTION
MODULATED SIGNAL B TRANSMITTING SECTION
FRAME CONFIGURATION SIGNAL GENERATION SECTION
CODING SECTION
INTER-LEAVING SECTION
MODULATION SECTION
SPREADING SECTION
RADIO SECTION
4801
4802
4803
4804
4805
304
305
306
307
308
309
310
311
312
4806
4807
4808
4809
4810
314
315
316
317
318
319
320
321
322
323
324

FIG.49

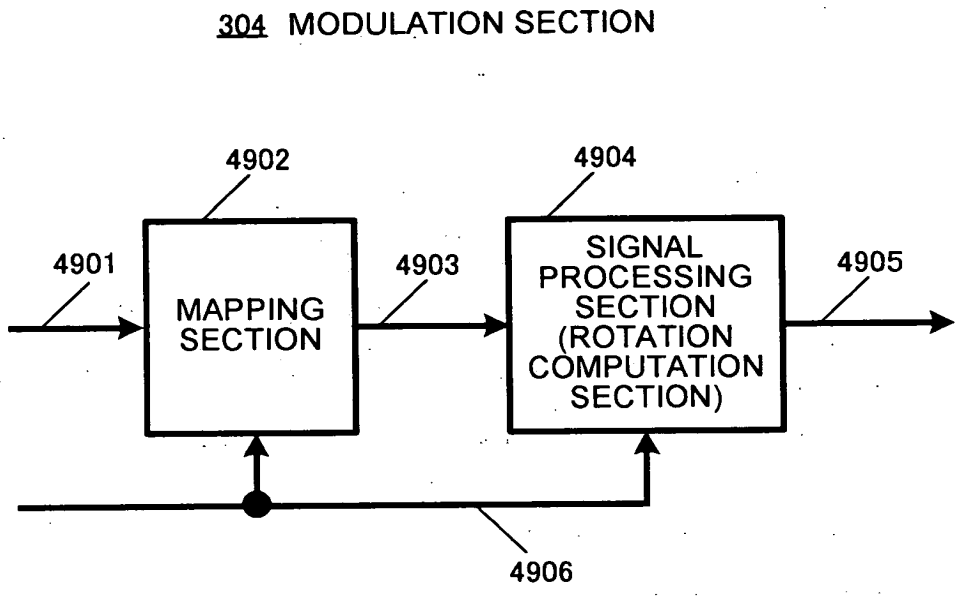

304 MODULATION SECTION
4902
4904
4901
MAPPING SECTION
4903
SIGNAL PROCESSING SECTION (ROTATION COMPUTATION SECTION)
4905
4906

FIG.50

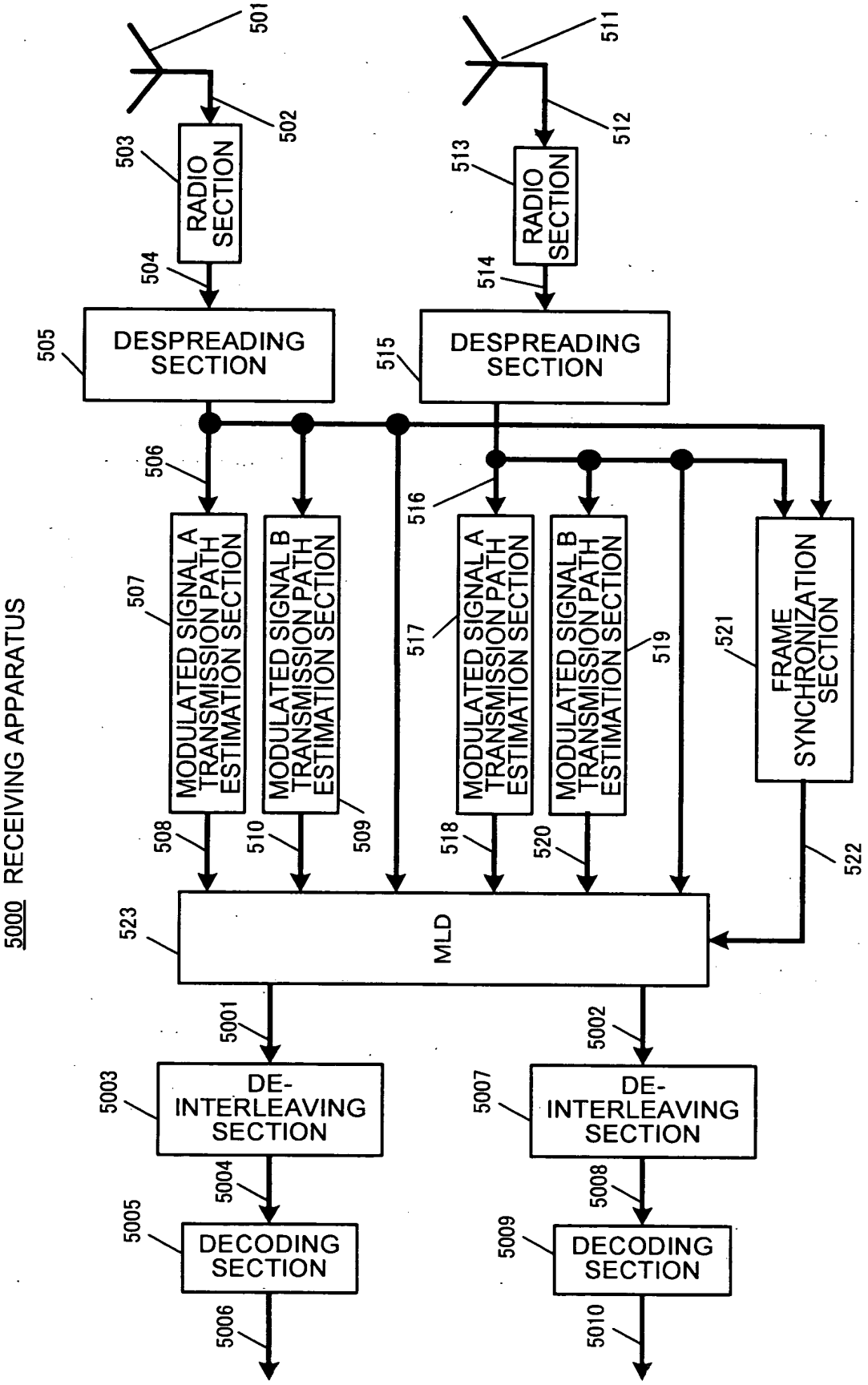

5000 RECEIVING APPARATUS
501
502
503
RADIO SECTION
504
505
DESPREADING SECTION
511
512
513
RADIO SECTION
514
515
DESPREADING SECTION
506
507
MODULATED SIGNAL A TRANSMISSION PATH ESTIMATION SECTION
508
MODULATED SIGNAL B TRANSMISSION PATH ESTIMATION SECTION
509
510
516
517
MODULATED SIGNAL A TRANSMISSION PATH ESTIMATION SECTION
518
MODULATED SIGNAL B TRANSMISSION PATH ESTIMATION SECTION
519
520
521
FRAME SYNCHRONIZATION SECTION
522
523
MLD
5001
5002
5003
DE-INTERLEAVING SECTION
5004
5005
DECODING SECTION
5006
5007
DE-INTERLEAVING SECTION
5008
5009
DECODING SECTION
5010

FIG.51

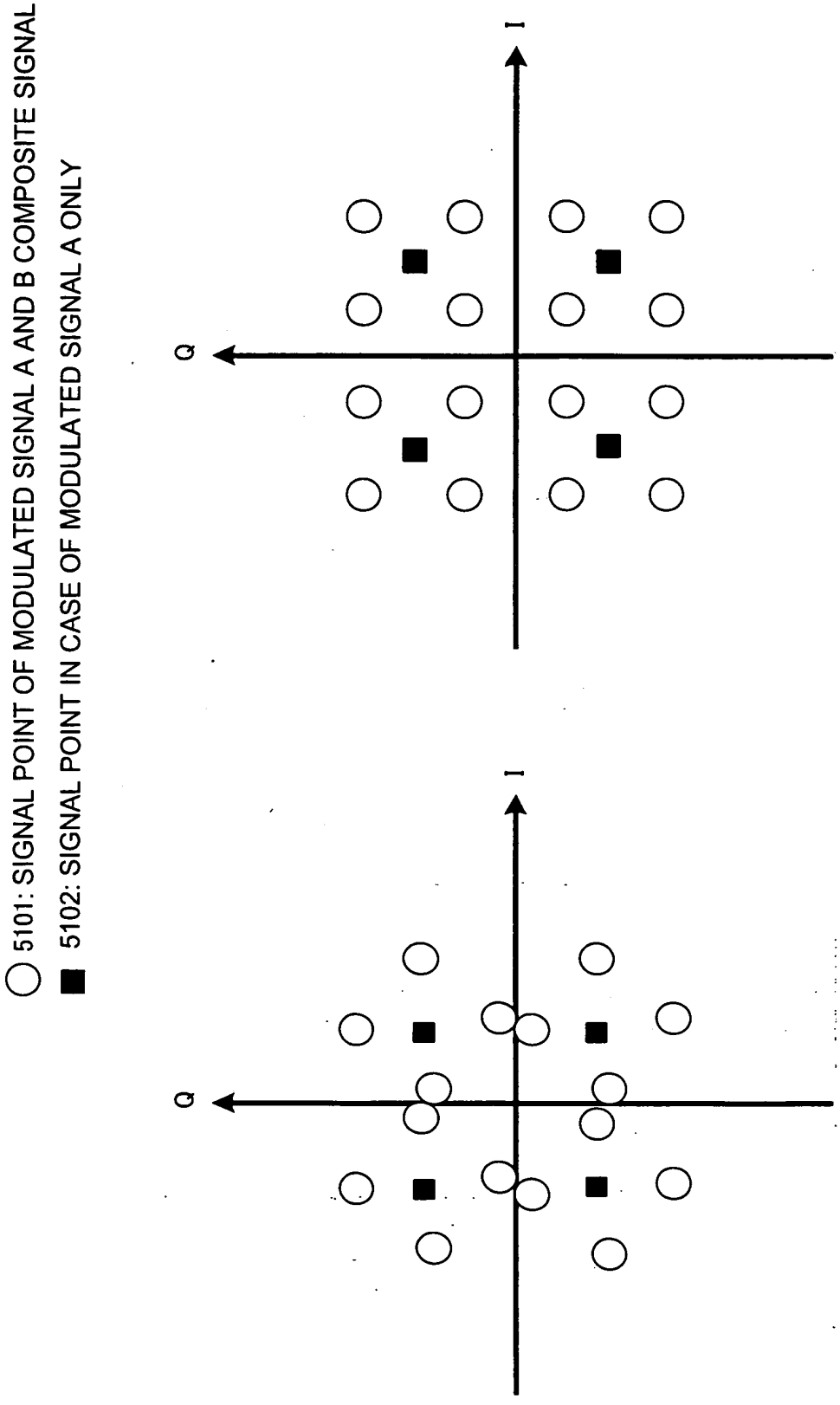
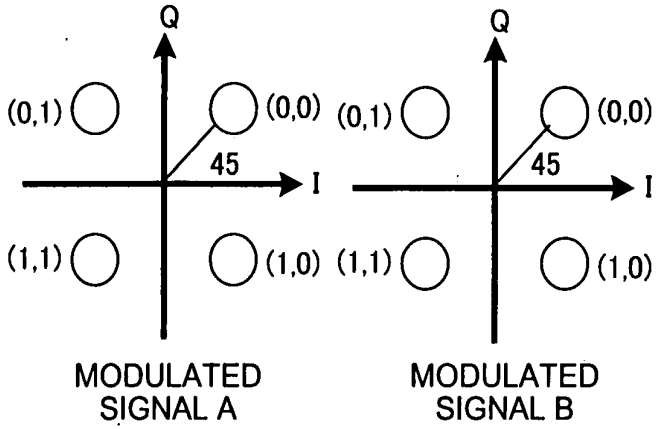


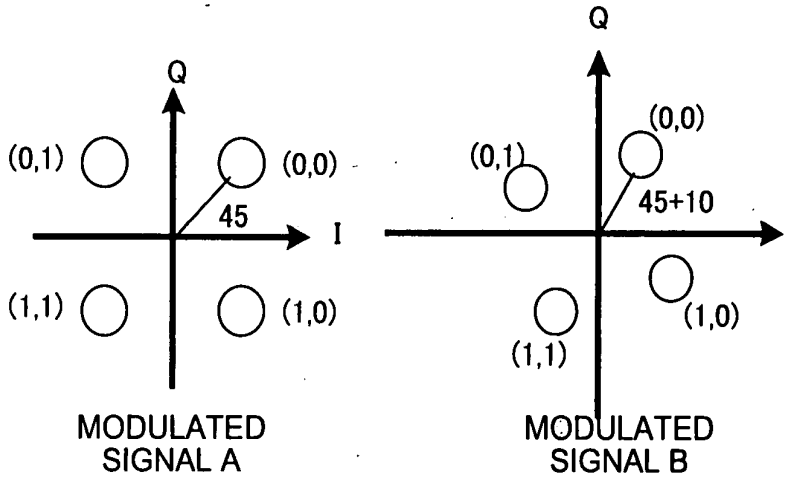
FIG.52B

FIG.52A



SIGNAL POINT ARRANGEMENTS AT TIME i

FIG.53A



SIGNAL POINT ARRANGEMENTS AT TIME i+1

FIG.53B

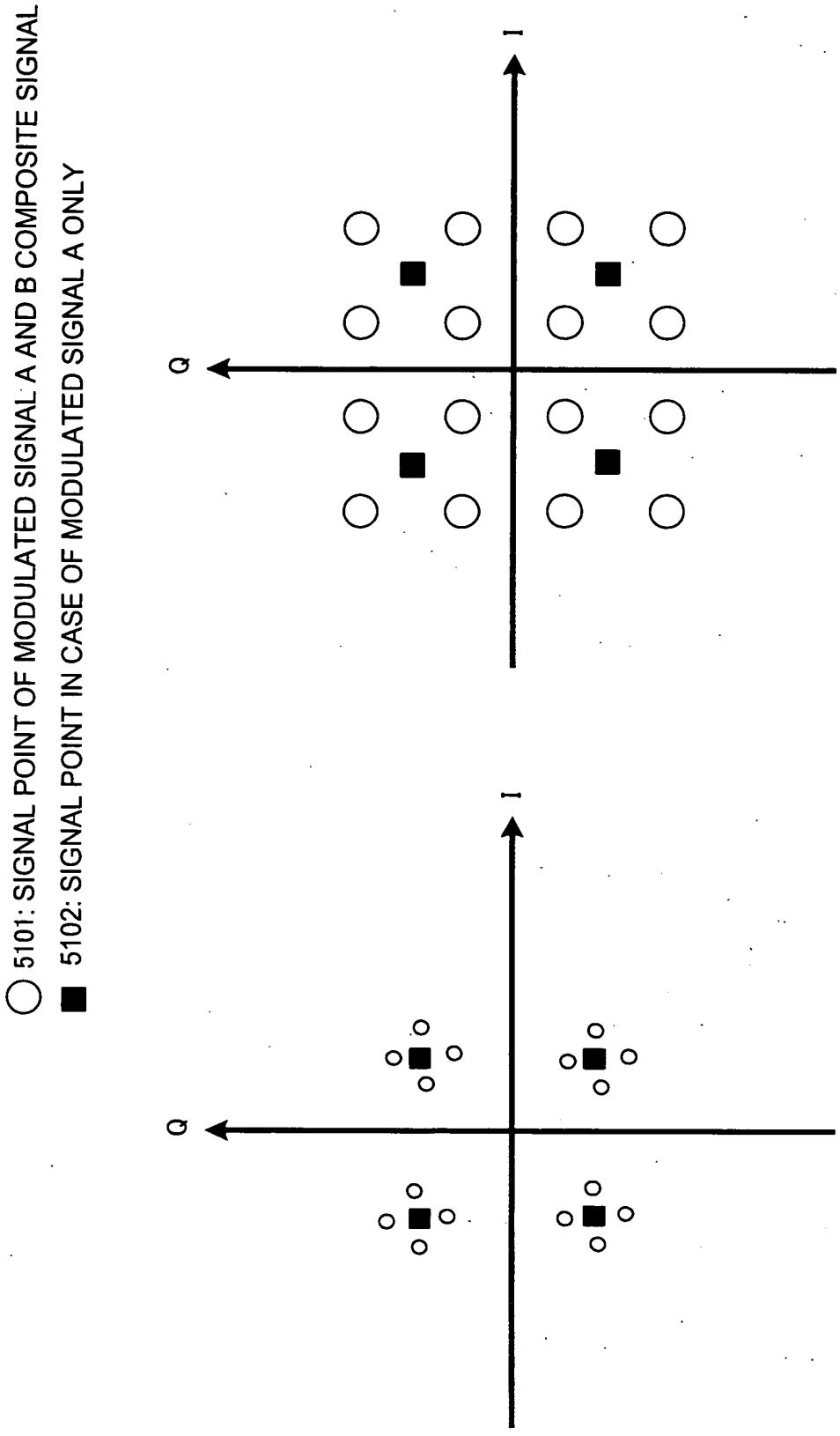


FIG.54B

FIG.54A

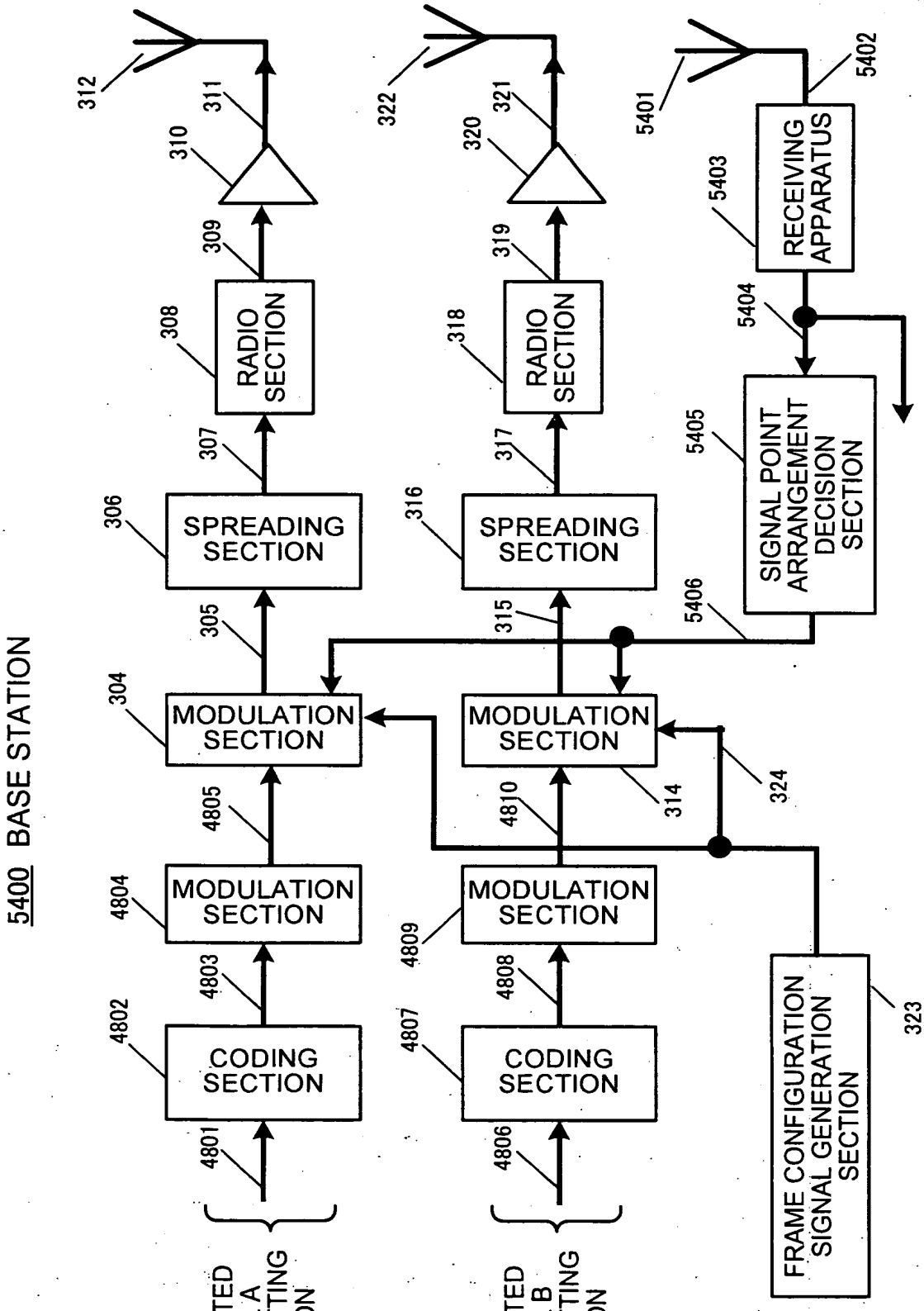

5400 BASE STATION
MODULATED SIGNAL A TRANSMITTING SECTION
MODULATED SIGNAL B TRANSMITTING SECTION
CODING SECTION
MODULATION SECTION
SPREADING SECTION
RADIO SECTION
SIGNAL POINT ARRANGEMENT DECISION SECTION
RECEIVING APPARATUS
FRAME CONFIGURATION SIGNAL GENERATION SECTION
4801
4802
4803
4804
4805
304
305
306
307
308
309
310
311
312
4806
4807
4808
4809
4810
314
315
316
317
318
319
320
321
322
323
324
5401
5402
5403
5404
5405
5406

FIG.55

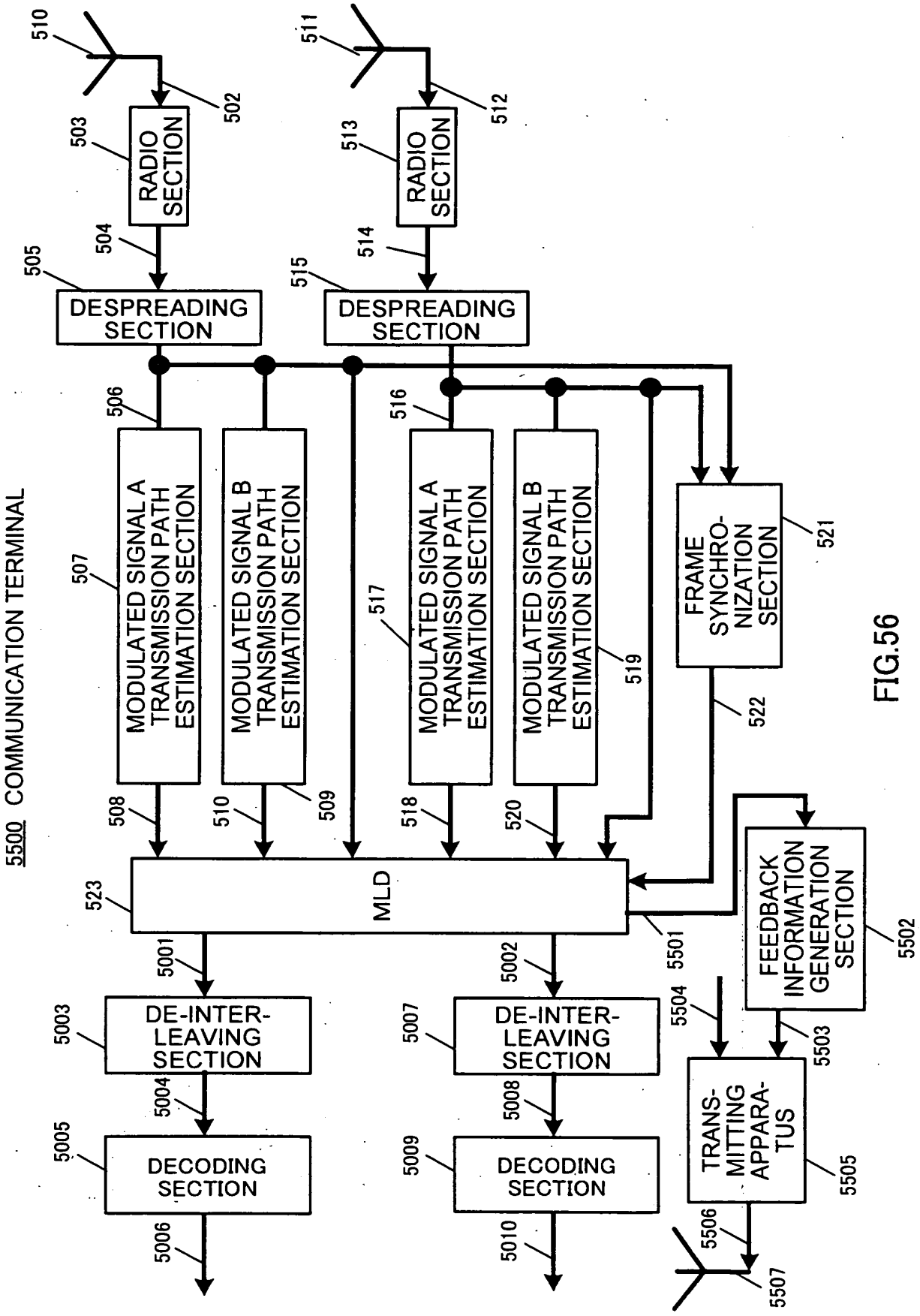

5500 COMMUNICATION TERMINAL
510
511
502
512
503
RADIO SECTION
513
RADIO SECTION
504
514
505
DESPREADING SECTION
515
DESPREADING SECTION
506
516
MODULATED SIGNAL A TRANSMISSION PATH ESTIMATION SECTION
MODULATED SIGNAL B TRANSMISSION PATH ESTIMATION SECTION
MODULATED SIGNAL A TRANSMISSION PATH ESTIMATION SECTION
MODULATED SIGNAL B TRANSMISSION PATH ESTIMATION SECTION
FRAME SYNCHRO-NIZATION SECTION
507
517
519
521
522
508
510
509
518
520
523
MLD
5501
5001
5002
FEEDBACK INFORMATION GENERATION SECTION
5502
5504
5503
DE-INTER-LEAVING SECTION
DE-INTER-LEAVING SECTION
5003
5007
5004
5008
DECODING SECTION
DECODING SECTION
TRANS-MITTING APPARA-TUS
5005
5009
5505
5006
5010
5506
5507

FIG.56

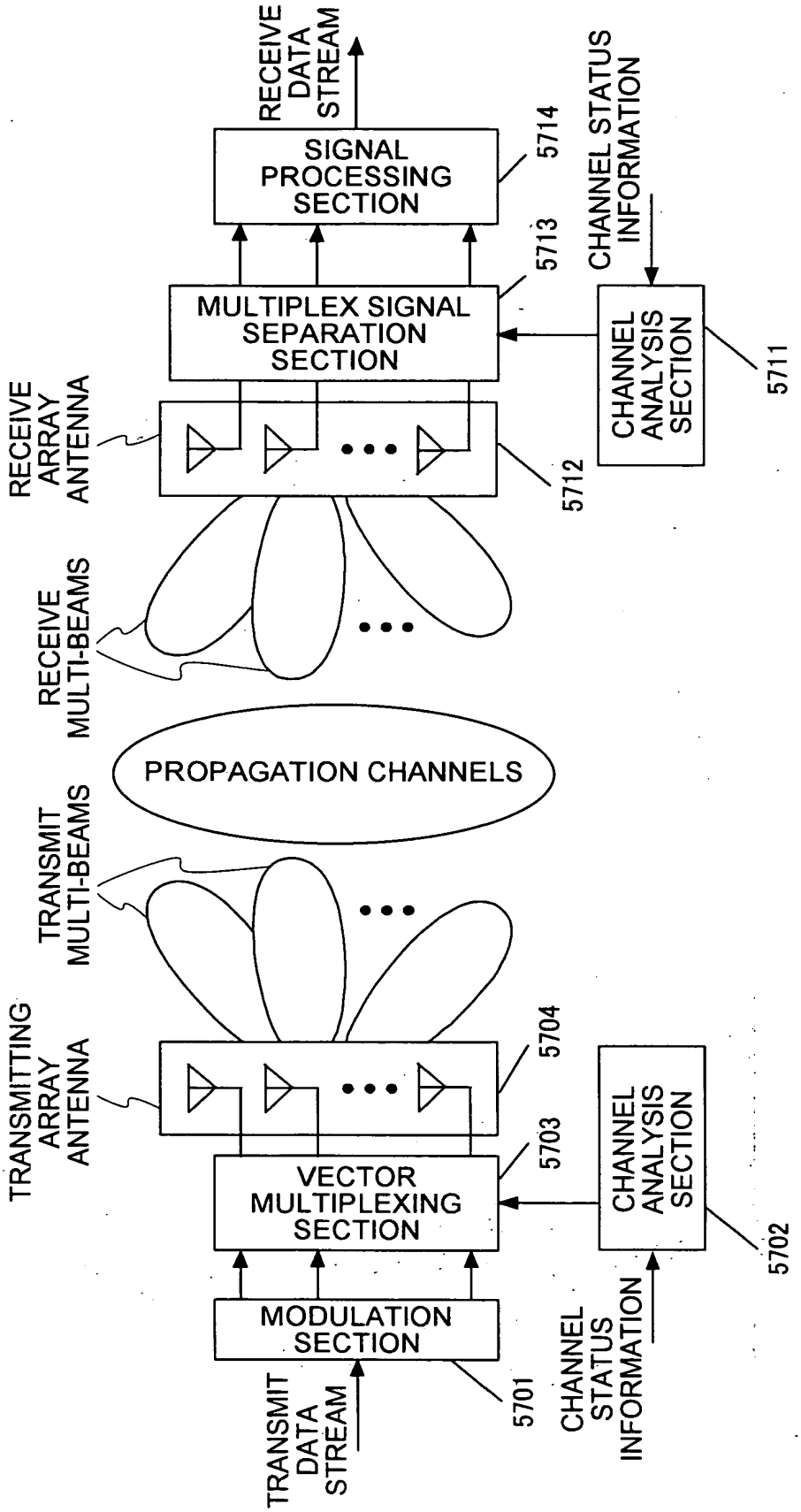

RECEIVE DATA STREAM
SIGNAL PROCESSING SECTION
5714
CHANNEL STATUS INFORMATION
5713
MULTIPLEX SIGNAL SEPARATION SECTION
CHANNEL ANALYSIS SECTION
5711
RECEIVE ARRAY ANTENNA
5712
RECEIVE MULTI-BEAMS
PROPAGATION CHANNELS
TRANSMIT MULTI-BEAMS
TRANSMITTING ARRAY ANTENNA
5704
5703
VECTOR MULTIPLEXING SECTION
CHANNEL ANALYSIS SECTION
5702
MODULATION SECTION
5701
TRANSMIT DATA STREAM
CHANNEL STATUS INFORMATION

FIG.57